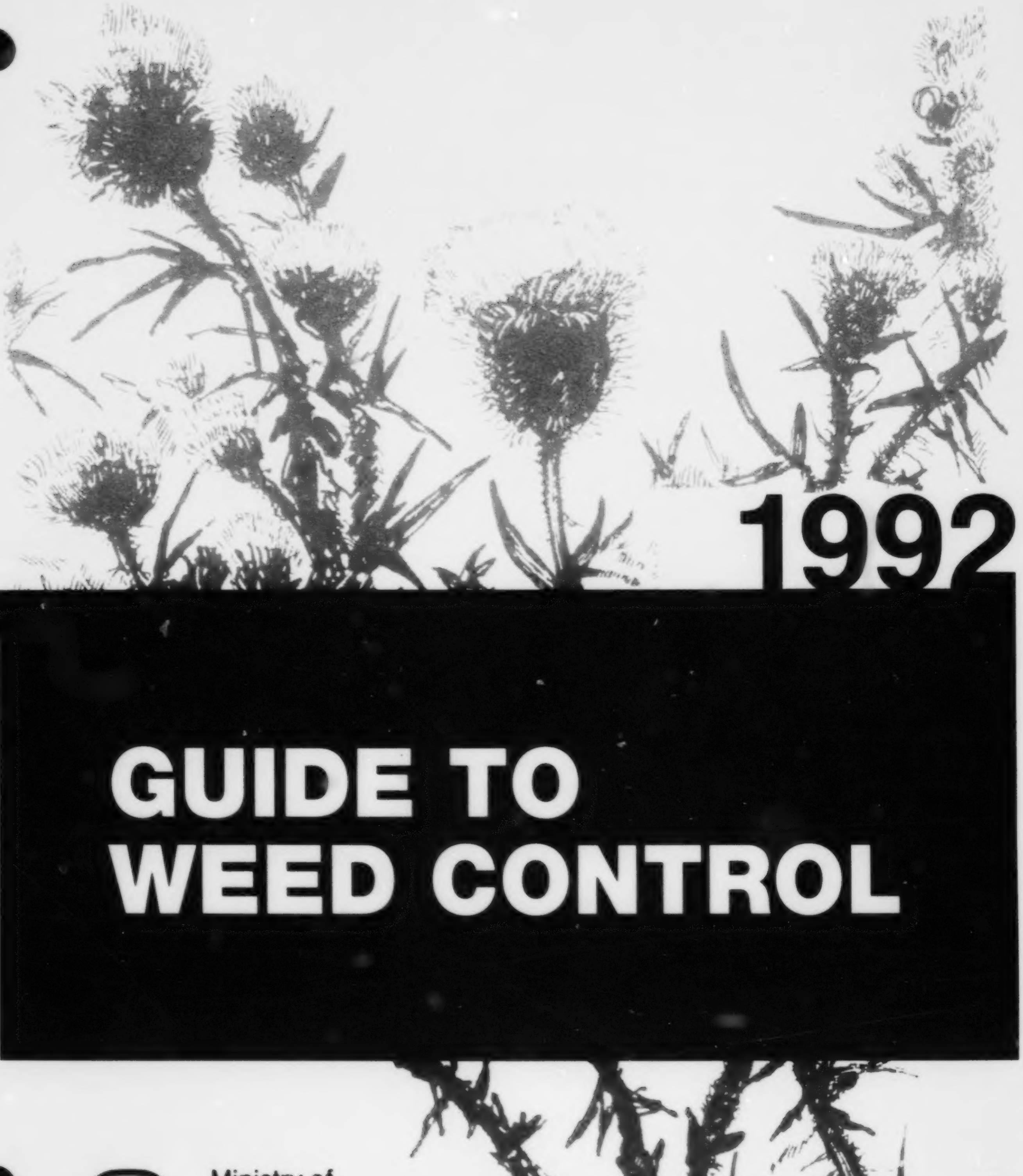
PUBLICATION 75



1992

GUIDE TO WEED CONTROL

Ministry of
Agriculture
and Food

Ontario

AGDEX 641

To the best of the collective knowledge of the members of the Ontario Weed Committee, all pesticides listed in this publication were federally registered, reviewed by the Ontario Pesticides Advisory Committee and classified by the Ministry of the Environment as of November 6, 1991.

Regulation 751 under the Pesticides Act requires that pesticides be used in accordance with the product label and in accordance with the Regulation. The information contained in this publication is general information only and is subject to the specific information and recommended uses listed on the pesticide container label and the provisions of Regulation 751.

PAY CLOSE ATTENTION TO ALL INSTRUCTIONS AND WARNINGS PRINTED ON THE PESTICIDE LABEL.

The Ministry of Agriculture and Food, or the Ontario Weed Committee by printing this publication does not offer any warranty or guarantee and they do not assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

POLICY STATEMENT

Weather and other factors influence the effectiveness of pesticides and the likelihood of plant injury by control chemicals. Consult the package label and other information regarding compatibility with other materials, the effect of high or low temperatures, poor drying conditions, etc. Wettable or soluble powders (WP or SP) generally are less likely to cause plant injury than liquid concentrates (EC,SC and Fl).

A number of brand names of pesticides are given in the calendars as a convenience to the grower and are neither an endorsement of the produce nor a suggestion that similar products are not effective.

The pesticide recommendations are reviewed annually by the Ontario Weed Committee. **OLD EDITIONS SHOULD BE DISCARDED.**

Health and Welfare Canada has established maximum residue limits (MRL's) for pesticides. However, growers should be aware that processors or retailers may demand different pesticide limits.

For additional information or clarification of recommendations, contact Ontario Ministry of Agriculture and Food personnel listed at the end of publication. Growers should seek advice of their intended market as to which restrictions or limitations are applicable.

FEDERAL REGISTRATION AND PROVINCIAL CLASSIFICATION

Ontario's Pesticides Act and Regulation 751, administered by the Ministry of the Environment, prohibits the sale and use of pesticide products unless they are registered under the federal Pest Control Products Act and classified under the provincial Pesticides Act by being placed in one of six schedules of the Ontario regulation.

FEDERAL REGISTRATION

1. *Full Registration*
   Implies that all federal departments involved in the registration process agreed that the data package was acceptable at the time of registration.
2. *Temporary Registration*
   Indicates that there is a need for additional scientific or technical information to acquire a full registration. Temporary registrations expire on the 31st day of December each year and the products must be re-registered if they are to be available for use in the following year.
3. *Temporary Registration (Restricted Class)*
   Indicates that there is an urgent need for the pesticide but that studies on the safety of the product are incomplete. Such registrations expire on the 31st of December each year and the products must be re-registered if they are to be available for use the following year. The pesticide product presently carrying a temporary registration (restricted class) is: Goal (oxyfluorfen). This material may, or may not, be available for use in 1992.

PROVINCIAL CLASSIFICATION

Pesticide products are classified into six schedules in Regulation 751 on the basis of their toxicity, environmental or health hazard, persistence of the active ingredient or its metabolites, concentration and usage. This classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario.

For updated information on the regulatory status of these or other pesticides contact the Pesticides Section, Hazardous Contaminants Coordination Branch, Ministry of the Environment, Toronto Telephone (416) 323-5095.

92-05084/

CONTENTS

GENERAL

Address and Phone List - OME, OMAF, Agriculture Canada . . . 195
Applying Herbicides . . . 5
Conversion Tables - Metric / Imperial . . . 204
Daily Herbicide Application Record . . . 206
Emergency and First-aid Procedures for Pesticide Poisoning . . . IBC
Federal Registration and Provincial Classification . . . IFC
Federal Registration and Provincial Classification . . . IFC
Members of The Ontario Weed Committee . . . 2
Notes on Chemicals . . . 15
Policy Statement . . . IFC
Precautions With All Pesticides . . . 200
Principles of Preventative Weed Control . . . 3
Use Herbicides Safely . . . IBC
Use of Chemicals to Control Weeds . . . 4
Weed Control Glossary . . . 2

APPLICATION TECHNOLOGY

Care and Use of Equipment . . . 40
Determining the Amount of Herbicides Needed . . . 43
Materials, Mixing and Mixtures . . . 43
Sprayer Calibration . . . 42

FIELD CROPS

Conventional

Beans (White, Snap and Kidney) . . . 45
Canola (Rapeseed) - Spring Planted . . . 51
Canola (Rapeseed) Triazine Tolerant . . . 52
Corn, Field and Sweet . . . 54
Flax-linseed . . . 73
Forage Legumes (Direct Seeded) . . . 75
Forage Legumes (Established) . . . 77
Pasture Renovation with Bird's-foot Trefoil . . . 79
Pastures (Mostly Grasses) . . . 79
Peanuts . . . 82
Soybeans . . . 83
Sunflowers . . . 93
Tobacco (Flue-cured and Burley) . . . 96
Wheat (Spring), Oats and Barley Not Underseeded to Forage Crops . . . 97
Wheat (Spring), Oats and Barley Underseeded to Forage Crops . . . 102
Wheat (Winter) and Fall Rye Underseeded To Clovers . . . 104
Wheat (Winter) and Fall Rye . . . 105

Conservation

Conservation Tillage . . . 107

HORTICULTURAL CROPS

Vegetables

Vegetable Crops . . . 111
Asparagus . . . 111
Beans (Lima) . . . 114
Beets (Red) . . . 116
Cabbage, Cauliflower, Broccoli, Brussels Sprouts . . . 117
Carrots . . . 118
Celery . . . 119
Cucumber . . . 120
Dill (see Herbicidal Oil Under Carrots) . . . 121
Lettuce . . . 121
Muskmelon, Watermelon, Squash and Pumpkin . . . 121
Onions . . . 122
Parsley (see Herbicidal Oil Under Carrots) . . . 124
Parsnips . . . 124
Peas . . . 124
Peppers . . . 126
Potatoes . . . 126
Rutabaga . . . 131
Spinach . . . 131
Tomatoes . . . 132
Tomatoes (Transplanted) . . . 132
Tomatoes (Field Seeded) . . . 135

Fruit

Cultural Weed Control in Fruit and Ornamental Crops . . . 138
Apples . . . 139
Apricots . . . 141
Cherries & Plums . . . 142
Grapes . . . 142
Peaches . . . 144
Pears . . . 145

Berries

Blueberries, Highbush . . . 148
Caneberries (Raspberries And Blackberries) . . . 149
Cranberries . . . 150
Currants and Gooseberries . . . 150
Raspberries and Blackberries (see Caneberries) . . . 151
Strawberries . . . 151

Ornamental

Herbaceous Ornamentals . . . 155
Herbaceous Ornamentals - Gladioli . . . 156
Herbaceous Ornamentals - Iris . . . 157
Shelterbelts (Windbreaks) . . . 157
Shelterbelts (Windbreaks) Established . . . 158
Shelterbelts (Windbreaks) Transplanted . . . 159
Turf Establishment . . . 159
Turfgrass (Lawns, Parks And Golf Courses) . . . 160
Turfgrass Renovation . . . 163
Turfgrass Retardation . . . 163
Woody Nursery Stock - Field Grown Nursery Stock . . . 163
Woody Nursery Stock: Container . . . 166
Woody Nursery Stock: Container Bed Preparation . . . 166
Woody Nursery Stock: Container Stock, Post Planting . . . 167

Other

Other Horticultural Uses . . . 169
Driveways, Patios And Paths . . . 169
Eradicating Persistent Perennials Or Shrubs . . . 169
Seedbeds And Potting Soil . . . 170
Special Methods Of Weed Control - Site Preparation . . . 170

ROADSIDES AND NON-CROP AREAS

Nonaquatic

Brush Control . . . 173
Evergreen or Conifer Control . . . 175
General Treatments for Woody Species . . . 176
Perennial Weed Control (Non Crop Land) . . . 177
Poison-ivy Control . . . 179
Reduction Of Herbicidal Drift . . . 180
Roadsides And Non-crop Areas . . . 180
Roadside Grass Retardation (see Turf Grass Retardation Section) . . . 181
Roadside Weed Control . . . 181
Vegetation Control-long Term Non Selective . . . 183
Vegetation Control-short Term Non-selective . . . 184
Weed Control In Dry Ditches . . . 184

Aquatic

Water Weeds (Aquatic Plants) . . . 188
Algae and Vascular Submergents . . . 189

TABLES

Table 1. Herbicides Used in Ontario . . . 6
Table 2. White, Snap or Kidney Bean Herbicide Weed Control Ratings . . . 50
Table 3A. Corn Herbicide Weed Control Ratings (Preplant or Post Harvest Applications) . . . 56
Table 3B. Corn Herbicide Weed Control Ratings (Preplant Incorporated Applications) . . . 58
Table 3C. Corn Herbicide Weed Control Ratings (Preemergence Applications) . . . 63
Table 3D. Corn Herbicide Weed Control Ratings (Postemergence Applications) . . . 69
Table 4. Soybean Herbicide Weed Control Ratings . . . 90
Table 5. Sunflower Herbicide Weed Control Ratings . . . 95
Table 6. Spring Cereal Herbicide Weed Control Ratings . . . 101
Table 7. Winter Wheat and Fall Rye Herbicide Weed Control Ratings . . . 104
Table 8. Vegetable Herbicide Weed Control Ratings . . . 136
Table 9. Fruit Crop Herbicide Weed Control Ratings . . . 146
Table 10. Strawberry Herbicide Weed Control Ratings . . . 154
Table 11. Nursery Herbicide Weed Control Ratings . . . 168
Table 12. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Spray . . . 186
Table 13. Habitats and Herbicide Susceptibility of Common Aquatic Plants . . . 192
Table 14. Classification of Weeds According to Response to Various Foliage Sprays . . . 193

Prepared by
MEMBERS OF THE ONTARIO WEED COMMITTEE

Ontario Agricultural College, University of Guelph
  J.F. Alex, G.W. Anderson, J.C. Hall, V. Souza
  Machado, G.R. Stephenson, C.J. Swanton,
  R.A. Upfold

Agriculture Canada
  A. Macdonald, F. Montambault, Ottawa;
  A.S. Hamill, S.E. Weaver, Harrow; B.F. Zilkey, Delhi

Crop Protection Institute of Canada
  L.M. Murray and A.G. McFadden

Ontario Hydro
  B.M. Allen,
  W. Welch, Toronto

Ontario Pesticides Advisory Committee
  D. Mewett, Toronto

Ontario Ministry of the Environment
  Toronto, Vacant

Ontario Ministry of Natural Resources
  M. Irvine, Sault Ste. Marie

Ontario Ministry of Transportation
  A.J. Stripnieks, N.P. Cain, F. Buchanan, Toronto

Ontario Ministry of Agriculture and Food
  Plant Industry Branch
  P. Beaudin, Plantagenet; J. Harvey, Simcoe
  H. Martin, St. Thomas; L. Huffman, Harrow;
  R.D. McLaren(Secretary), Guelph

College of Agricultural Technology
  R.H. Brown, J.E.Shaw, Ridgetown;
  D.W. MacDonald, Kemptville;
  J. O'Toole (Chairman and Editor),
  W.B. Brolley, Centralia; J. Heard, Thunder Bay

Horticultural Research Institute of Ontario
  J. O. Sullivan, Simcoe

Agricultural Laboratory Services
  B. Archibald, B.S. Clegg, Guelph

Ontario Soil & Crop Improvement Association
  Larry Lamb, Emo;
  E. Webster, Landsdown

WEED CONTROL GLOSSARY

(Also see Notes on Chemicals)

ACID (2,4-D glyphosate) - the active part of the product being used - usually indicated in grams per L on the label

ACTIVE INGREDIENT - the chemical compound in a product that is responsible for the herbicide effects.

ADJUVANT - an ingredient added to a spray mixture to aid or modify the action of the herbicide, or to alter the physical characteristics of the mixture.

AMINE - a formulation of chemical which is relatively non volatile under most climatic conditions.

BAND TREATMENT - a herbicide applied as a narrow strip over the crop row, usually followed by inter-row cultivation.

COMPATIBLE - compounds or formulatons that can be mixed and applied together without undesirably altering their separate effects.

CONTACT CHEMICALS - chemicals which kill only the parts of the plant on which they are sprayed.

DIRECTED TREATMENT - a treatment directed onto the weeds or soil in such a manner as to avoid contact with the crop.

DORMANT - a resting stage similar to the condition of a plant during the winter.

EMERGENCE - the time at which the seedling first appears above the ground.

ESCAPE - a plant in a treated area that has been missed or survived the treatment.

ESTER - type of formulation of a chemical.

FORMULATION - means the same as PRODUCT - an active ingredient processed with other materials to make it usable; or, the type of herbicide commercially available, such as amine, low volatile ester or sodium salt of 2,4-D.

HERBICIDE - a chemical which is used to kill or inhibit weeds.

HORMONE-TYPE HERBICIDE - includes 2,4-D, 2,4-DB, mecoprop MCPA, MCPB, dichlorprop, dicamba, TBA, picloram.

LOW VOLATILE ESTER - a formulation of chemical which, after application and under certain climatic conditions, may cause damage to sensitive crops and landscape plants by vapor activity.

NONSELECTIVE HERBICIDE - a chemical used in such a manner that all vegetation - both weed and crop - is damaged.

PERENNIAL - a plant that lives for more than 2 years.

PRODUCT - the contents of a herbicide container as marketed. It contains the active ingredient and other solvents, surfactants or carriers that are referred to as inert ingredients.

PROGRAM - application of one or more herbicides at two different stages of crop and/or weed growth. The second herbicide application is used to provide control of the weeds either escaping the original herbicide treatment or which are problems at different periods in the growth of the crop.

RESISTANT - a crop not damaged by a herbicide if applied as recommended, or a weed not controlled by any practical rate of herbicide.

SELECTIVE HERBICIDE - a chemical used in such a manner that it will kill weeds on a growing crop without damaging the crop.

SODIUM SALT - type of formulation of a chemical.

SOIL STERILANT - a nonselective chemical that acts through the soil to prevent the growth of plants.

SURFACTANT - an ingredient in or added to the herbicide formulation to improve the dispersing, spreading, sticking or wetting properties of the spray mixture.

SUSCEPTIBLE - a crop that may be damaged - or a weed that may be controlled readily by a recommeded rate of herbicide.

TANK MIX - two chemicals that are packaged separately and mixed in the sprayer tank.

TRANSLOCATED HERBICIDE - a chemical (herbicide) that moves within the plant.

PRINCIPLES OF PREVENTATIVE WEED CONTROL

As with most agricultural practices, the effectiveness of the weed control methods depends upon weather conditions, soil type, cropping history on the farm, and even the unique character of the farmer himself. In addition to this, maintaining favorable soil conditions for microbial activity is the preferable "first line of defence" against weeds.

There are many ways to control weeds and reduce weed problems. Identifying weeds and knowing their particular growth habits is a first step. Using weed free crop seeds and transplants and preventing weeds from going to seed in both crop and non crop areas are good strategies.

Practices that increase the biological (bacteria, fungi, earthworms, insects, etc) activity of the soil, can reduce weed problems. This biological activity can speed the decay of weed seeds in the soil, increase the vigor of the crop etc. Excessive amounts of pesticides, tillage, fertilizer, fresh manure, etc., can reduce biological activity in the soil.

Crop Rotation

Maintaining a good crop rotation is very important in developing a sound long term weed control strategy. This rotation of crops, tillage methods, row widths and harvesting systems breaks weed cycles and reduces pest (weed) buildup. Short rotations using several crops will increase yield and profit for each individual crop. Improved weed control can be obtained by choosing a crop that competes well with the problem weeds.

Cover Crops

Cover crops should be an integral part of the crop rotation. These include plowdown crops like rye, red clover, buckwheat and oilseed radish or overwintering production crops like winter wheat and forage stands. These crops suppress weed growth through crop competition and allelopathy, as well as provide protection to the soil. When choosing a cover crop, always consider how the cover crop will affect the following crop.

MECHANICAL METHODS OF WEED CONTROL

Preemergent or "Blind" Harrowing

Blind harrowing consists of waiting until after the crop has been planted, the seed is sprouted and the shoot is about to emerge. At this crucial time, the field is harrowed to kill the small weed seedlings which have already sprouted. The crop will emerge shortly afterwards, having gained a competitive advantage on the next generation of weeds to emerge. When properly carried out, this method can be most effective in controlling annual weeds in large seeded crops. In cereals, this blind harrowing will often provide adequate control of annual broadleaved weeds. In row crops, it can be employed as an interim measure to keep ahead of weeds until the crop plants are large enough to withstand other mechanical control methods. Any type of light harrow can be used. Blind harrowing must not be done on crops underseeded with grass or legumes.

Weeder Harrow

A weeder harrow has spring tines that are gentle enough not to harm the cultivated crop, while uprooting or covering the smaller annual weeds. Understandably then, the relative size of the cultivated plants and the weeds is important. This technique will be most successful when used in conjunction with "blind harrowing". Specially designed weeder harrows have been developed for use on field crops at various stages of development. They can be used most effectively on field vegetables, corn, soybeans, and cereals.

Rotary Hoe

The rotary hoe has fingers which lift and mix the soil thereby uprooting small weeds. Sufficient speed, generally 10-20 km/hr, must be maintained to obtain satisfactory results. Best results are obtained during late morning or afternoon hours when the hot sun can dry out the uprooted weeds. Also, crop plants tend to be more pliable at this time and injury is reduced. Rotary hoes tend to cause less crop damage than harrows. They are also effective in breaking up a soil crust and incorporating surface applied herbicides into the soil to activate the chemical and to improve the weed control. On light soils or under loose soil conditions care must be taken to keep the rotary hoe working shallow.

Inter-Row Cultivation

Shallow inter-row cultivation or scuffling of row crops uproots small weeds and cuts off larger weeds. Various types of equipment can be used, but when shovels are used, allow for up to 50% overlap for thorough weed control. Shields should be used to protect small crops.

Row cultivation can be used profitably in conjunction with herbicide application. The effectiveness of the herbicide may be improved and the amount of herbicide used can be reduced particularly with band applications. To provide adequate control in long season crops, such as corn, scuffling will probably have to be done more than once. The first cultivation is the most crucial since weeds that escape this pass will usually grow to maturity. Here again the relative size of the crop to the weeds is important and probably the limiting factor in achieving 100% success. The previously outlined techniques using bling harrowing, weeder harrows and rotary hoes are useful in setting up suitable conditions to produce good results with inter-row cultivators.

Mowing

Mowing or cutting weeds may be used to assist in controlling weeds in orchards, roadsides, lawns, etc. Harvesting hay or cereal crops also helps to control weeds. Mowing cereal stubble in early August can reduce weed growth and weed seed production, especially if the cereal had been underseeded to another crop such as red clover to compete with the new weed growth. The best time to mow perennial weeds is usually at the bud stage when root reserves are low and before seed set. Note that if a herbicide application is planned for later in the season, adequate time should be left for weed regrowth after mowing.

For more information, see individual crop sections.

THE USE OF CHEMICALS TO CONTROL WEEDS

Chemicals may be used for the control of weeds either **selectively** in crops or **nonselectively** for the control of perennial weeds or on land not in crops, such as roadsides, fencerows and areas difficult to cultivate.

The treatments listed in this publication are based on extensive field and observation on farms. **Herbicides should not be used in cold frames or greenhouses unless specifically recommended.**

The grower should not rely on only one chemical or practice over a period of years. For example 2,4-D controls most broadleaf annual weeds but it does not kill grasses. When the broadleaf weeds have been killed, the weeds not controlled can become a serious problem. The use of ATRAZINE in a continuous corn program may not provide adequate control of late germinating annual grasses. These weeds may be controlled by the use of some other herbicide, or by a change in the method of using the desired herbicide.

Time of Herbicide Treatment in Crop Areas

The susceptibility of both crops and weeds to herbicides is related to the time of application. Therefore, it is important to use the chemical at a time when the crop is at its maximum resistance and the weeds are at their maximum susceptibility. This time will vary depending on the crop involved and the herbicide being used. Different terms of describing the times at which herbicides may be applied have come into general use. Unless specified differently, these times refer to the stage of development of the crop plants.

PREPLANTING TREATMENTS - Preplanting treatments are applied before the crop area is sown or planted.

Some herbicides used in this way act on germinating seedlings, others may also kill weed seeds. Most herbicides when used preplanting must be thoroughly incorporated with the soil soon after application. Directions for incorporation are given throughout the publication where these materials are recommended.

PREEMERGENCE TREATMENTS - Chemicals used in preemergence treatments are applied after seedling but before the specified weed or crop emerges. The chemicals may control weeds by (1) killing weed seedlings and/or (2) establishing a toxic layer of chemical on or near the soil surface in which germinating seeds and young seedlings cannot survive.

For successful preemergence treatments the crops must either be tolerant of the chemical at the seedling state or the toxicity must have disappeared before the crop emerges.

A smooth, well prepared seedbed which is free of clods is necessary for best results. The surface soil should also be moist and the temperature favorable for the rapid germination of weed seed.

POSTEMERGENCE TREATMENTS - Postemergence treatments are applied after the crop and weeds have emerged. A selective chemical is used and the weeds are killed with little damage to the desirable plants. The types of weeds that may be controlled depend on (1) the susceptibility of the weed, and (2) the tolerance of the crop to the chemical. Treatment at the correct stage of crop development is important. Since most weeds are more susceptible to chemicals when young, early treatments will require less herbicide and will result in less damage to crops from weed competition and from spray equipment.

Sometimes a herbicide may be applied postemergence to the crop but preemergence to the weeds. For example, a crop may be cultivated, then a herbicide applied to the weed free soil to control subsequent germinating weeds.

Chemical Weed Control in Non-Crop Areas

TREATMENT WITH "SOIL STERILANTS" - Perennial weeds may be killed and the growth of annual weeds prevented by the use of soil active chemicals which are toxic to most plants. These "soil sterilants" may be applied at any time. Best results are obtained if application is followed by a period of rainfall.

TREATMENT WITH TRANSLOCATED CHEMICALS - In eliminating perennial weeds, heavier dosages of 2,4-D and of other translocated chemicals must be applied than would normally be used in cropland. Mixtures of 2,4-D with other chemicals may be used to keep areas free from vegetation.

TREATMENT WITH CONTACT CHEMICALS - These chemicals are not selective but kill all foliage they contact. While this will kill annual weeds, regrowth usually develops from the roots or crowns of perennial plants.

Applying Herbicides

An exterminator's licence may be required by a person applying herbicides on property other than his own domestic property. An operator's licence is required by a person operating an extermination business. **For further information**, contact any Minsitry of the Environment Regional Office or the Ministry of the Environment Pesticides Section, 135 St. Clair Avenue West, Toronto, M4V 1P5.

Successful chemical weed control requires the application of the correct quantity of herbicide uniformly over the area. With selective weed control in field crops, this application becomes a precision operation with reliable equipment.

The chemical is applied as an emulsion, solution, or suspension. The volume of the mixture used per hectare depends on the herbicide and the crop being treated. Generally low volumes (50 to 200 L per hectare) are used when 2,4-D chemicals are sprayed on emerged weeds, and higher volumes (150 to 300 L per hectare) when preemergence herbicides are applied.

Small areas may be treated with a garden sprayer, or even with a watering can, if care is taken to wet all foliage.

Power equipment is necessary for larger areas. Equipment used for applying 2,4-D like chemicals should not be used later for applying other solutions to 2,4-D susceptible crops or garden plants.

The possibility of damage to nearby crops or plants from herbicide drift is increased by the use of high pressure, small nozzle tips, herbicide dusts or mists. Every precaution should be taken to ensure that no drift occurs from the treated areas.

The application of herbicides by mist or air blast sprayers in agricultural areas of Ontario is NOT recommended.

Application of herbicides by aircraft may be feasible, particularly where large areas of a crop are grown in a solid block. Because of the potential for increased drift when aerial application is practised, it is necessary to use every precaution. Such precautions include spraying at a time of day (early morning or evening) when drift due to wind is more apt to be minimal. It may be wise to prespray areas near susceptible crops or trees with ground equipment, thus leaving the larger open areas for aerial application.

In general, aerial application of hormone type herbicides such as 2,4-D is NOT recommended in agricultural areas where susceptible crops may be damaged. It is recognized, however, that some hormone type herbicides are being applied by aircraft in certain areas such as on cereal crops grown where no susceptible crops, trees, gardens, etc., will be affected.

Aerial applicators must be licenced by the Ontario Ministry of the Environment to apply pesticides. In addition, permits are required from the Ontario Ministry of the Environment under the Pesticides Act for the aerial application of Schedules 1 and 5 herbicides, Schedule 2 hormone type herbicides, and paraquat. The area to be sprayed must be inspected by Ministry personnel to ensure that spraying can be done without injury to susceptible crops.

HERBICIDE DRIFT

Vapor drift is the movement of fine particles from a herbicide that tends to give off vapor at the time of or after application. Vapors will increase as temperature rises. Vaporization reduces the effect of the herbicide application and increases the danger to nearby susceptible crops.

Spray driftis the windborne movement of fine spray particles away from the intended target areas. Drift will occur any time that the wind is strong enough to carry the particles. Damage caused by drift will depend on how much herbicide escapes and on the susceptibility of the crop or plants that it reaches. High pressure, small nozzles and wind will increase the danger of drift. Lower pressures, larger nozzles, a larger volume of water and spraying only when wind speeds are low will decrease the danger.

Handy Metrics Conversion Factor

Litres per hectare x 0.4 = litres per acre

Kilograms per hectare x 0.4 = kilograms/ac

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
2,4-D	2,4-D	Sn	500 g/L	2.00	3	-	***
2,4-D	2,4-D	Sn	500 g/L	2.00	3	-	***
2,4-D	AQUA-KLEEN	Gr	20	5.00	2	C	RHON
2,4-D	ESTAMINE 2,4-D	Sn	470 g/L	2.13	3	A	GREE
2,4-D BUTYRIC	2,4-DB	EC	400 g/L	2.50	2	B	***
2,4-D/ dicamba/ mecoprop	KILLEX 500	Sn	479 g/L	2.09	3	A	GREE
2,4-D/ dicamba/ mecoprop	KILLEX SUMMER FORMULA	Sn	320 g/L	3.13	3	A	GREE
2,4-D/ dicamba/ mecoprop	KILMOR	Sn	485 g/L	2.06	3	A	CIBA
2,4-D/ dicamba/ mecoprop	PAR III	Sn	308 g/L	3.25	3	A	UAP
2,4-D/ dicamba/ mecoprop	TRICEP	Sn	318 g/L	3.14	3	A	CHIP
2,4-DB	2,4-D BUTYRIC	EC	400 g/L	2.50	2	B	***
2,4-DB	COBUTOX	EC	400 g/L	2.50	2	B	UCO
2,4-DB	EMBUTOX 625	EC	625 g/L	1.60	2	B	RHON
AATREX	atrazine	Su	480 g/L	2.08	2	B	CIBA
AATREX NINE-O	atrazine	WG	90	1.11	2	C	CIBA
AATREX-PLUS	atrazine + oil	Su	400 g/L	2.50	2	B	CIBA
AFESIN	monolinuron	EC	200 g/L	5.00	3	A^1	HOEC
AFOLAN F	linuron	Su	480 g/L	2.08	3	A	HOEC
AGRICULTURAL WEED KILLER NO. 1	mineral oil (herbicidal)	Li	100	1.00	6	C	VWR
ALANAP	naptalam NPA	Sn	240 g/L	4.17	3	A	UNIR
ALGIMYCIN PLL-C	copper citrate and gluconate	PE	5	20.00	2	C	UAP
ALGIMYCIN PLL-C (LI)	copper citrate and gluconate	Li	50 g/L	20.00	2	-	GRBC
AMIBEN	chloramben	Gr	10	10.00	3	C	RHON
AMITROL-T	amitrole	Sn	200 g/L	5.00	3	A^2	RHON
amitrole	AMITROL-T	Sn	200 g/L	5.00	3	A^2	RHON
ammonium sulphamate	POISON IVY & BRUSH KILLER	Sn	500 g/L	2.00	3	-	WILS
ammonium sulphate	BASF LIQUID AMMONIUM SULPHATE	Li	490 g/L	2.04	6	-	BASF
AQUA-KLEEN	2,4-D	Gr	20	5.00	2	C	RHON
AQUASHADE	water soluble dyes	Sn	26	3.85	2	A	RHON
ASSURE	quizalofop-ethyl	EC	96 g/L	10.42	5	A	DUPO
ATRA-MIX	atrazine + oil	Su	400 g/L	2.50	2	B	CHIP
atrazine	AATREX	Su	480 g/L	2.08	2	B	CIBA
atrazine	AATREX NINE-O	WG	90	1.11	2	C	CIBA
atrazine + oil	AATREX-PLUS	Su	400 g/L	2.50	2	B	CIBA
atrazine + oil	ATRA-MIX	Su	400 g/L	2.50	2	B	CHIP

HOW TO USE THE CONVERSION FACTOR

Multiply recommendation of amount of active ingredient in text by the conversion factor to get the amount of product to use.
Example **Dry materials:** To apply 1.1 kg/ha linuron to control annual weeds in carrots
LOROX DF (50% active) 1.1 x 2.00 = 2.2 kg/ha (product)

Liquid or flowable: To apply 1.5 kg/ha atrazine to control seedling weeds in corn
AATREX (480 g/L active) 1.5 x 2.08 = 3.12 L/ha (product)

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
atrazine	ATRAZINE 480	Su	480 g/L	2.08	2	B	***
atrazine	ATRAZINE 500	Su	500 g/L	2.00	2	B	***
atrazine	ATRAZINE 80W	WP	80	1.25	2	C	***
atrazine	ATRAZINE 90W	WP	90	1.11	2	C	***
atrazine	ATRAZINE FLOWABLE	Su	470 g/L	2.13	2	B	***
atrazine	PRIMOTOL NINE-O	WG	90	1.11	2	C	CIBA
ATRAZINE 480	atrazine	Su	480 g/L	2.08	2	B	***
ATRAZINE 500	atrazine	Su	500 g/L	2.00	2	B	***
ATRAZINE 80W	atrazine	WP	80	1.25	2	C	***
ATRAZINE 90W	atrazine	WP	90	1.11	2	C	***
ATRAZINE FLOWABLE	atrazine	Su	470 g/L	2.13	2	B	***
atrazine/ simazine	EKKO	WP	(1:1) 80	1.25	2	C	CIBA
AVADEX BW	triallate	EC	400 g/L	2.50	2	A	MONS
AVENGE 200C	difenzoquat	Sn	200 g/L	5.00	3	A	CYAN
BANVEL 480	dicamba	Sn	480 g/L	2.08	2	B	SAND
BASAGRAN	bentazon	Sn	480 g/L	2.08	3	B	BASF
BASAMID	dazomet	Gr	98	1.02	2	C	BASF
BASF LIQUID AMMONIUM SULPHATE	ammonium sulphate	Li	490 g/L	2.04	6	-	BASF
bensulide	BETASAN	EC	480 g/L	2.08	3	A	CHIP
bensulide	BETASAN (GR)	Gr	12.5	8.00	3	-	CHIP
bensulide	PREFAR	EC	480 g/L	2.08	3	A	CHIP
bentazon	BASAGRAN	Sn	480 g/L	2.08	3	B	BASF
bentazon/ atrazine	LADDOK	Su	(1:1) 400 g/L	2.50	2	A	BASF
BETASAN	bensulide	EC	480 g/L	2.08	3	A	CHIP
BETASAN (GR)	bensulide	Gr	12.5	8.00	3	-	CHIP
BLADEX LIQUID	cyanazine	Su	480 g/L	2.08	2	B	CIBA
BLADEX NINE-T	cyanazine	WG	90	1.11	2	C	CIBA
BLAGAL	cyanazine/ MCPA	Sn	(1:2) 375 g/L	2.67	2	B	CIBA
bromacil	HYVAR X	WP	80	1.25	2	C	DUPO
bromacil	HYVAR X-L	Sn	240 g/L	4.17	2	C	DUPO
bromacil/ 2,4-D	CALMIX PELLETS	PE	3 + 5	12.50	3	C	RHON
bromacil/ diuron	KROVAR	WP	(1:1) 80	1.25	2	C	DUPO
bromoxynil	PARDNER	EC	280 g/L	3.57	2	C	RHON
bromoxynil/ MCPA	BUCTRIL M	EC	(1:1) 560 g/L	1.79	2	C	RHON
BUCTRIL M	bromoxynil/ MCPA	EC	(1:1) 560 g/L	1.79	2	C	RHON
butylate/ atrazine	SUTAZINE^{+}	EM	(4:1) 720 g/L	1.39	2	A	CHIP
butylate/ R25788 (butylate^{+})	SUTAN^{+}	EC	800 g/L	1.25	3	C	CHIP
CALMIX PELLETS	bromacil/ 2,4-D	PE	3 + 5	12.50	3	C	RHON
CASORON	dichlobenil	Gr	4	25.00	3	C	UAP
chloramben	AMIBEN	Gr	10	10.00	3	C	RHON
chloramben	GARDEN WEED PREVENTER	Gr	4	25.00	3	C	HILL
chlorpropham	CIPC	Gr	20	5.00	2	C	PPG
chlorpropham	CIPC EC	EC	480 g/L	2.08	2	-	PPG
chlorpropham	CIPC GR	Gr	10	10.00	2	C	PPG
chlorsulfuron	GLEAN	DF	75	1.33	2	C	DUPO
chlorthal dimethyl	DACTHAL	Gr	2.3	43.48	3	C	FERM
chlorthal dimethyl	DACTHAL GR	Gr	5	20.00	3	C	FERM
chlorthal dimethyl	DACTHAL WP	WP	75	1.33	3	C	FERM
CIPC	chlorpropham	Gr	20	5.00	2	C	PPG
CIPC EC	chlorpropham	EC	480 g/L	2.08	2	-	PPG
CIPC GR	chlorpropham	Gr	10	10.00	2	C	PPG

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manu-fac-turer's Code
CLEAR-IT 1	glyphosate	Sn	7 g/L	142.9	4	B	MONS
CLEAR-IT 2	glyphosate	Sn	38 g/L	26.32	4	B	MONS
CLEAR-IT 3	glyphosate	Sn	143 g/L	6.99	4	B	MONS
clopyralid	LONTREL	Sn	200 g/L	5.00	3	A	DWEL
COBUTOX	2,4-DB	EC	400 g/L	2.50	2	B	UCO
COMPITOX	mecoprop	Sn	150 g/L	6.67	3	A	RHON
COMPITOX PLUS	mecoprop/ 2,4-D	Sn	(1:1) 200 g/L	5.00	3	A	RHON
copper citrate and gluconate	ALGIMYCIN PLL-C	PE	5	20.00	2	C	UAP
copper citrate and gluconate	ALGIMYCIN PLL-C (LI)	Li	50 g/L	20.00	2	-	GRBC
copper ethanolamine	CUTRINE PLUS	Sn	9	11.11	2	A	WECO
copper ethanolamine	CUTRINE PLUS (GRANULAR)	Gr	3.7	27.03	2	B	WECO
copper ethanolamine	CUTRINE PLUS (SOLUTION)	Sn	130 g/L	7.69	2	A	WECO
CUTRINE PLUS	copper ethanolamine	Sn	9	11.11	2	A	WECO
CUTRINE PLUS (GRANULAR)	copper ethanolamine	Gr	3.7	27.03	2	B	WECO
CUTRINE PLUS (SOLUTION)	copper ethanolamine	Sn	130 g/L	7.69	2	A	WECO
cyanazine	BLADEX LIQUID	Su	480 g/L	2.08	2	B	CIBA
cyanazine	BLADEX NINE-T	WG	90	1.11	2	C	CIBA
cyanazine/ MCPA	BLAGAL	Sn	(1:2) 375 g/L	2.67	2	B	CIBA
cycloate	RO-NEET	EC	720 g/L	1.39	3	C	CHIP
DACTHAL	chlorthal dimethyl	Gr	2.3	43.48	3	C	FERM
DACTHAL GR	chlorthal dimethyl	Gr	5	20.00	3	C	FERM
DACTHAL WP	chlorthal dimethyl	WP	75	1.33	3	C	FERM
dazomet	BASAMID	Gr	98	1.02	2	C	BASF
DESORMONE	dichlorprop/ 2,4-D	EC	(1:1) 680 g/L	1.47	2	B	RHON
DEVRINOL 10G	napropamide	Gr	10	10.00	3	C	CHIP
DEVRINOL 50W	napropamide	WP	50	2.00	3	C	CHIP
dicamba	BANVEL 480	Sn	480 g/L	2.08	2	B	SAND
dicamba	DYCLEER	Sn	480 g/L	2.08	2	B	SAND
dicamba/ 2,4-D	DYCLEER 24	Sn	(1:2) 582 g/L	1.72	2	B	SAND
dicamba/ atrazine	MARKSMAN	Fl	(1:2) 388 g/L	2.58	2	B	SAND
dicamba/ MCPA	DYVEL	Sn	(1:4) 420 g/L	2.38	2	B	SAND
dicamba/ MCPA/ mecoprop	TARGET	Sn	400 g/L	2.50	3	A	CIBA
dichlobenil	CASORON	Gr	4	25.00	3	C	UAP
dichlorprop/ 2,4-D	DESORMONE	EC	(1:1) 680 g/L	1.47	2	B	RHON
dichlorprop/ 2,4-D	DIPHENOPROP	EC	(1:1) 700 g/L	1.43	2	B	UAP
dichlorprop/ 2,4-D	DIPHENOPROP (600 G/L)	EC	(1:1) 600 g/L	1.67	2	B	UAP
dichlorprop/ 2,4-D	DIPHENOPROP, SEE	EC	(1:1) 444 g/L	2.25	2	B	UAP
dichlorprop/ 2,4-D	ESTAPROP	EC	(282:300) 582 g/L	1.72	2	B	RHON
dichlorprop/ 2,4-D	SILVAPROP	EC	700 g/L	1.43	2	B	RHON
dichlorprop/ 2,4-D	WEEDONE CB	Sn	(1:1) 160 g/L	6.25	2	C	RHON
diclofop-methyl	HOE-GRASS 284	EC	284 g/L	3.52	3	A	HOEC
difenzoquat	AVENGE 200C	Sn	200 g/L	5.00	3	A	CYAN
DIPHENOPROP	dichlorprop/ 2,4-D	EC	(1:1) 700 g/L	1.43	2	B	UAP
DIPHENOPROP (600 G/L)	dichlorprop/ 2,4-D	EC	(1:1) 600 g/L	1.67	2	B	UAP
DIPHENOPROP, SEE	dichlorprop/ 2,4-D	EC	(1:1) 444 g/L	2.25	2	B	UAP
diquat	REGLONE	Sn	200 g/L	5.00	3	A	CHIP
diquat(aquatic)	REGLONE A	Sn	200 g/L	5.00	3	A	CHIP

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
diuron	KARMEX	DF	80	1.25	2	C	DUPO
DUAL	metolachlor	EC	960 g/L	1.04	2	B	CIBA
DYCLEER	dicamba	Sn	480 g/L	2.08	2	B	SAND
DYCLEER 24	dicamba/ 2,4-D	Sn	(1:2) 582 g/L	1.72	2	B	SAND
DYVEL	dicamba/ MCPA	Sn	(1:4) 420 g/L	2.38	2	B	SAND
EDGE	ethalfluralin	DF	50	2.00	3	C	DWEL
EKKO	atrazine/ simazine	WP	(1:1) 80	1.25	2	C	CIBA
EMBUTOX 625	2,4-DB	EC	625 g/L	1.60	2	B	RHON
EPTAM	EPTC	EC	800 g/L	1.25	3	C	CHIP
EPTC	EPTAM	EC	800 g/L	1.25	3	C	CHIP
EPTC/ R25788 (EPTC$^+$)	ERADICANE	EC	800 g/L	1.25	3	C	CHIP
ERADICANE	EPTC/ R25788 (EPTC$^+$)	EC	800 g/L	1.25	3	C	CHIP
ESTAMINE 2,4-D	2,4-D	Sn	470 g/L	2.13	3	A	GREE
ESTAMINE MCPA	MCPA	Sn	500 g/L	2.00	3	A	GREE
ESTAPROP	dichlorprop/ 2,4-D	EC	(282:300) 582 g/L	1.72	2	B	RHON
ethalfluralin	EDGE	DF	50	2.00	3	C	DWEL
EXCEL	fenoxaprop-ethyl	EC	90 g/L	11.11	3	A	HOEC
EXPEDITE BROADLEAF	mecoprop/ 2,4-D	Sn	(1:2) 186 g/L	5.38	2	A	MONS
EXPEDITE GRASS & WEED	glyphosate	Sn	147 g/L	6.80	3	A	MONS
EZJECT	glyphosate	P		0.00	3	C	MONS
fenoxaprop-ethyl	EXCEL	EC	90 g/L	11.11	3	A	HOEC
flamprop-methyl	MATAVAN	EC	84 g/L	11.90	2	A	DUPO
fluazifop-butyl	FUSILADE	EC	250 g/L	4.00	5	C	CHIP
fosamine ammonium	KRENITE	Sn	480 g/L	2.08	3	B	DUPO
FUSILADE	fluazifop-butyl	EC	250 g/L	4.00	5	C	CHIP
GARDEN WEED PREVENTER	chloramben	Gr	4	25.00	3	C	HILL
GARLON 4	triclopyr	EC	480 g/L	2.08	2	B	DWEL
GESAGARD	prometryne	WP	80	1.25	2	C	CIBA
GLEAN	chlorsulfuron	DF	75	1.33	2	C	DUPO
glyphosate	CLEAR-IT 1	Sn	7 g/L	142.9	4	B	MONS
glyphosate	CLEAR-IT 2	Sn	38 g/L	26.32	4	B	MONS
glyphosate	CLEAR-IT 3	Sn	143 g/L	6.99	4	B	MONS
glyphosate	EXPEDITE GRASS & WEED	Sn	147 g/L	6.80	3	A	MONS
glyphosate	EZJECT	P		0.00	3	C	MONS
glyphosate	LAREDO	Sn	356 g/L	2.81	3	B	MONS
glyphosate	ROUNDUP	Sn	356 g/L	2.81	3	B	MONS
glyphosate	VISION	Sn	356 g/L	2.81	2	B	MONS
glyphosate	WRANGLER	Sn	356 g/L	2.81	3	B	MONS
GOAL	oxyfluorfen	EC	192 g/L	5.21	1	A	ROHM
GRAMOXONE	paraquat	Sn	200 g/L	5.00	2	A	CHIP
HERBEC 20 P	tebuthiuron	PE	20	5.00	2	C	DWEL
hexazinone	PRONONE	Gr	10	10.00	2	C	UAP
hexazinone	VELPAR	SP	90	1.11	2	C	DUPO
HOE-GRASS 284	diclofop-methyl	EC	284 g/L	3.52	3	A	HOEC
HYVAR X	bromacil	WP	80	1.25	2	C	DUPO
HYVAR X-L	bromacil	Sn	240 g/L	4.17	2	C	DUPO
imazethapyr	PURSUIT	Sn	240 g/L	4.17	2	A	CYAN
KARMEX	diuron	DF	80	1.25	2	C	DUPO

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manu-facturer's Code
KERB	propyzamide	WP	50	2.00	3	C	ROHM
KILLEX 500	2,4-D/ dicamba/ mecoprop	Sn	479 g/L	2.09	3	A	GREE
KILLEX SUMMER FORMULA	2,4-D/ dicamba/ mecoprop	Sn	320 g/L	3.13	3	A	GREE
KILMOR	2,4-D/ dicamba/ mecoprop	Sn	485 g/L	2.06	3	A	CIBA
KRENITE	fosamine ammonium	Sn	480 g/L	2.08	3	B	DUPO
KROVAR	bromacil/ diuron	WP	(1:1) 80	1.25	2	C	DUPO
LADDOK	bentazon/ atrazine	Su	(1:1) 400 g/L	2.50	2	A	BASF
LAREDO	glyphosate	Sn	356 g/L	2.81	3	B	MONS
LENTAGRAN	pyridate	WP	45	2.22	3	A	UAP
LEXONE DF	metribuzin	DF	75	1.33	2	C	DUPO
LEXONE DF TOSS'N GO	metribuzin	DF	75	1.33	2	C[3]	DUPO
LEXONE L	metribuzin	Sn	480 g/L	2.08	3	B	DUPO
linuron	AFOLAN F	Su	480 g/L	2.08	3	A	HOEC
linuron	LINURON 480	Su	480 g/L	2.08	3	A	UAP
linuron	LOROX DF	DF	50	2.00	3	C	DUPO
linuron	LOROX DF TOSS'N GO	DF	50	2.00	3	C[3]	DUPO
linuron	LOROX L	Su	480 g/L	2.08	3	A	DUPO
LINURON 480	linuron	Su	480 g/L	2.08	3	A	UAP
LONTREL	clopyralid	Sn	200 g/L	5.00	3	A	DWEL
LOROX DF	linuron	DF	50	2.00	3	C	DUPO
LOROX DF TOSS'N GO	linuron	DF	50	2.00	3	C[3]	DUPO
LOROX L	linuron	Su	480 g/L	2.08	3	A	DUPO
maleic hydrazide	ROYAL MH 60 SG	SG	60	1.67	3	C	UNIR
MARKSMAN	dicamba/ atrazine	Fl	(1:2) 388 g/L	2.58	2	B	SAND
MATAVAN	flamprop-methyl	EC	84 g/L	11.90	2	A	DUPO
MCPA	ESTAMINE MCPA	Sn	500 g/L	2.00	3	A	GREE
MCPA	MCPA AMINE	Sn	500 g/L	2.00	3	A	***
MCPA	MCPA-SODIUM SALT	Sn	assorted	0.00	3	A	***
MCPA	METHOXONE	Sn	500 g/L	2.00	3	A	CHIP
MCPA	METHOXONE SODIUM	Sn	300 g/L	3.33	3	A	CHIP
MCPA AMINE	MCPA	Sn	500 g/L	2.00	3	A	***
MCPA-SODIUM SALT	MCPA	Sn	assorted	0.00	3	A	***
MCPB/MCPA	TROPOTOX PLUS	Sn	(15:1) 400 g/L	2.50	3	A	RHON
MCPP	mecoprop	Sn	assorted	0.00	3	A	***
MECO-D	mecoprop/ 2,4-D	Sn	(1:1.9) 435 g/L	2.30	3	A	***
mecoprop	COMPITOX	Sn	150 g/L	6.67	3	A	RHON
mecoprop	MCPP	Sn	assorted	0.00	3	A	***
mecoprop	MECOPROP	Sn	150 g/L	6.67	3	A	***
MECOPROP	mecoprop	Sn	150 g/L	6.67	3	A	***
MECOPROP PLUS 2,4-D	mecoprop/ 2,4-D	Sn	(1:1) 194 g/L	5.15	3	A	UAP
mecoprop/ 2,4-D	COMPITOX PLUS	Sn	(1:1) 200 g/L	5.00	3	A	RHON
mecoprop/ 2,4-D	EXPEDITE BROADLEAF	Sn	(1:2) 186 g/L	5.38	2	A	MONS
mecoprop/ 2,4-D	MECO-D	Sn	(1:1.9) 435 g/L	2.30	3	A	***
mecoprop/ 2,4-D	MECOPROP PLUS 2,4-D	Sn	(1:1) 194 g/L	5.15	3	A	UAP
mecoprop/ 2,4-D	MECOTURF PLUS 2,4-D	Sn	(1:1) 400 g/L	2.50	3	A	RHON
mecoprop/ 2,4-D	PREMIUM LAWN WEED KILLER	Sn	(1:1) 250 g/L	4.00	3	A	HILL
mecoprop/ 2,4-D	TURF-RITE 2+2	Sn	(1:1) 400 g/L	2.50	3	A	SANX

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
MECOTURF PLUS 2,4-D	mecoprop/ 2,4-D	Sn	(1:1) 400 g/L	2.50	3	A	RHON
metam sodium	VAPAM	Sn	380 g/L	2.63	3	C	CHIP
METHOXONE	MCPA	Sn	500 g/L	2.00	3	A	CHIP
METHOXONE SODIUM	MCPA	Sn	300 g/L	3.33	3	A	CHIP
methyl bromide/ chloropicrin	TERR-O-GAS 67	Li	67 + 31	1.02	1	-	CIBA
methyl isothyiocyanate/ dichloropropene	VORLEX PLUS	Li	203 g + 373 g/L	1.74	2	B	NORA
methyl isothyiocyanate/ dichloropropene/ chloropicrin	VORLEX PLUS CP	Li	185 g + 370 g + 163 g/L	1.39	2	B	NORA
metobromuron	PATORAN	WP	50	2.00	2	C	CIBA
metobromuron	PATORAN FL	Su	400 g/L	2.50	2	A	CIBA
metolachlor	DUAL	EC	960 g/L	1.04	2	B	CIBA
metolachlor/ atrazine	PRIMEXTRA	Su	(3:2) 500 g/L	2.00	2	B	CIBA
metribuzin	LEXONE DF	DF	75	1.33	2	C	DUPO
metribuzin	LEXONE DF TOSS'N GO	DF	75	1.33	2	C^3	DUPO
metribuzin	LEXONE L	Sn	480 g/L	2.08	3	B	DUPO
metribuzin	SENCOR 500 F	Su	500 g/L	2.00	2	C	CHEM
metribuzin	SENCOR 75 DF	WG	75	1.33	2	C	CHEM
metribuzin	SENCOR SOLUPAK	WG	75	1.33	2	C	CHEM
mineral oil (herbicidal)	AGRICULTURAL WEED KILLER NO. 1	Li	100	1.00	6	C	VWR
monolinuron	AFESIN	EC	200 g/L	5.00	3	A^1	HOEC
napropamide	DEVRINOL 10G	Gr	10	10.00	3	C	CHIP
napropamide	DEVRINOL 50W	WP	50	2.00	3	C	CHIP
naptalam NPA	ALANAP	Sn	240 g/L	4.17	3	A	UNIR
NATA GRASS KILLER PELLETS	TCA , trichloroacetic acid	SG	85	1.18	3	C	HOEC
oxyfluorfen	GOAL	EC	192 g/L	5.21	1	A	ROHM
PAR III	2,4-D/ dicamba/ mecoprop	Sn	308 g/L	3.25	3	A	UAP
paraquat	GRAMOXONE	Sn	200 g/L	5.00	2	A	CHIP
paraquat/ diquat	WEED AND GRASS KILLER	SG	(1:1) 5	20.00	3	C	HILL
paraquat/ diquat	WEED-BAN	SG	(1:1) 5	20.00	3	C	HILL
paraquat/ simazine	TERRAKLENE	Su	(1:4) 500 g/L	2.00	2	A	CHIP
PARDNER	bromoxynil	EC	280 g/L	3.57	2	C	RHON
PATORAN	metobromuron	WP	50	2.00	2	C	CIBA
PATORAN FL	metobromuron	Su	400 g/L	2.50	2	A	CIBA
pebulate ,PEBC	TILLAM	EC	720 g/L	1.39	3	C	CHIP
pendimethalin	PROWL	EC	480 g/L	2.08	5	B	CYAN
picloram/ 2,4-D	TORDON 101 MIXTURE	Sn	(1:3.7) 305 g/L	3.28	2##	A^5	DWEL
PINNACLE	thifensulfuron- methyl	DF	75	1.33	3	C^3	DUPO
POAST	sethoxydim	EC	184 g/L	5.43	3	B^4	BASF
POISON IVY & BRUSH KILLER	ammonium sulphamate	Sn	500 g/L	2.00	3	-	WILS
PREFAR	bensulide	EC	480 g/L	2.08	3	A	CHIP
PREMIUM LAWN WEED KILLER	mecoprop/ 2,4-D	Sn	(1:1) 250 g/L	4.00	3	A	HILL
PRIMEXTRA	metolachlor/ atrazine	Su	(3:2) 500 g/L	2.00	2	B	CIBA

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
PRIMOTOL NINE-O	atrazine	WG	90	1.11	2	C	CIBA
PRINCEP NINE-T	simazine	WG	90	1.11	2	C	CIBA
prometryne	GESAGARD	WP	80	1.25	2	C	CIBA
PRONONE	hexazinone	Gr	10	10.00	2	C	UAP
propanil/ MCPA (LV ester)	STAMPEDE CM	EC	(3.6:1) 460 g/L	2.17	2	B	ROHM
propyzamide	KERB	WP	50	2.00	3	C	ROHM
PROWL	pendimethalin	EC	480 g/L	2.08	5	B	CYAN
PURSUIT	imazethapyr	Sn	240 g/L	4.17	2	A	CYAN
PYRAMIN FL	pyrazon	Su	430 g/L	2.33	3	B	BASF
pyrazon	PYRAMIN FL	Su	430 g/L	2.33	3	B	BASF
pyridate	LENTAGRAN	WP	45	2.22	3	A	UAP
quizalofop-ethyl	ASSURE	EC	96 g/L	10.42	5	A	DUPO
REGLONE	diquat	Sn	200 g/L	5.00	3	A	CHIP
REGLONE A	diquat(aquatic)	Sn	200 g/L	5.00	3	A	CHIP
RELEASE	triclopyr	EC	480 g/L	2.08	2	B	DWEL
RIVAL	trifluralin	EC	500 g/L	2.00	3	A	HOEC
RO-NEET	cycloate	EC	720 g/L	1.39	3	C	CHIP
ROUNDUP	glyphosate	Sn	356 g/L	2.81	3	B	MONS
ROYAL MH 60 SG	maleic hydrazide	SG	60	1.67	3	C	UNIR
SENCOR 500 F	metribuzin	Su	500 g/L	2.00	2	C	CHEM
SENCOR 75 DF	metribuzin	WG	75	1.33	2	C	CHEM
SENCOR SOLUPAK	metribuzin	WG	75	1.33	2	C	CHEM
sethoxydim	POAST	EC	184 g/L	5.43	3	B^4	BASF
SILVAPROP	dichlorprop/ 2,4-D	EC	700 g/L	1.43	2	B	RHON
SIMADEX	simazine	Su	500 g/L	2.00	2	A	NORA
simazine	PRINCEP NINE-T	WG	90	1.11	2	C	CIBA
simazine	SIMADEX	Su	500 g/L	2.00	2	A	NORA
simazine	SIMAZINE	WP	80	1.25	2	C	UAP
SIMAZINE	simazine	WP	80	1.25	2	C	UAP
SINBAR	terbacil	WP	80	1.25	2	C	DUPO
SPIKE 5 G	tebuthiuron	Gr	5	20.00	3	C	DWEL
SPIKE 80 WP	tebuthiuron	WP	80	1.25	2	C	DWEL
STAMPEDE CM	propanil/ MCPA (LV ester)	EC	(3.6:1) 460 g/L	2.17	2	B	ROHM
SUTAN$^+$	butylate/ R25788 (butylate$^+$)	EC	800 g/L	1.25	3	C	CHIP
SUTAZINE$^+$	butylate/ atrazine	EM	(4:1) 720 g/L	1.39	2	A	CHIP
TARGET	dicamba/ MCPA/ mecoprop	Sn	400 g/L	2.50	3	A	CIBA
TCA, trichloroacetic acid	NATA GRASS KILLER PELLETS	SG	85	1.18	3	C	HOEC
tebuthiuron	HERBEC 20 P	PE	20	5.00	2	C	DWEL
tebuthiuron	SPIKE 5 G	Gr	5	20.00	3	C	DWEL
tebuthiuron	SPIKE 80 WP	WP	80	1.25	2	C	DWEL
terbacil	SINBAR	WP	80	1.25	2	C	DUPO
TERR-O-GAS 67	methyl bromide/ chloropicrin	Li	67 + 31	1.02	1	-	CIBA
TERRAKLENE	paraquat/ simazine	Su	(1:4) 500 g/L	2.00	2	A	CHIP
thifensulfuron-methyl	PINNACLE	DF	75	1.33	3	C^3	DUPO
TILLAM	pebulate ,PEBC	EC	720 g/L	1.39	3	C	CHIP
TORDON 101 MIXTURE	picloram/ 2,4-D	Sn	(1:3.7) 305 g/L	3.28	2##	A^5	DWEL

Table 1. Herbicides Used In Ontario

Common, Brand and Trade Names* (see endnote)	Example of Brand Name* Products or Common or other name of active ingredient	Formulation** (see endnote)	Guarantee % active unless stated	Conversion Factor (see endnote)	Ontario Schedule (see endnote)	Winter Storage (see endnote)	Manufacturer's Code
TREFLAN	trifluralin	EC	545 g/L	1.83	3	B	DWEL
triallate	AVADEX BW	EC	400 g/L	2.50	2	A	MONS
TRICEP	2,4-D/ dicamba/ mecoprop	Sn	318 g/L	3.14	3	A	CHIP
triclopyr	GARLON 4	EC	480 g/L	2.08	2	B	DWEL
triclopyr	RELEASE	EC	480 g/L	2.08	2	B	DWEL
trifluralin	RIVAL	EC	500 g/L	2.00	3	A	HOEC
trifluralin	TREFLAN	EC	545 g/L	1.83	3	B	DWEL
trifluralin	TRIFLUREX 40 EC	EC	400 g/L	2.50	3	B	SHAM
TRIFLUREX 40 EC	trifluralin	EC	400 g/L	2.50	3	B	SHAM
TROPOTOX PLUS	MCPB/MCPA	Sn	(15:1) 400 g/L	2.50	3	A	RHON
TURF-RITE 2+2	mecoprop/ 2,4-D	Sn	(1:1) 400 g/L	2.50	3	A	SANX
VAPAM	metam sodium	Sn	380 g/L	2.63	3	C	CHIP
VELPAR	hexazinone	SP	90	1.11	2	C	DUPO
VERNAM	vernolate	EC	720 g/L	1.39	3	A	CHIP
vernolate	VERNAM	EC	720 g/L	1.39	3	A	CHIP
VISION	glyphosate	Sn	356 g/L	2.81	2	B	MONS
VORLEX PLUS	methyl isothyiocyanate/ dichloropropene	Li	203 g + 373 g/L	1.74	2	B	NORA
VORLEX PLUS CP	methyl isothyiocyanate/ dichloropropene/ chloropicrin	Li	185 g + 370 g + 163 g/L	1.39	2	B	NORA
water soluble dyes	AQUASHADE	Sn	26	3.85	2	A	RHON
WEED AND GRASS KILLER	paraquat/ diquat	SG	(1:1) 5	20.00	3	C	HILL
WEED-BAN	paraquat/ diquat	SG	(1:1) 5	20.00	3	C	HILL
WEEDONE CB	dichlorprop/ 2,4-D	Sn	(1:1) 160 g/L	6.25	2	C	RHON
WRANGLER	glyphosate	Sn	356 g/L	2.81	3	B	MONS

[1] *Store above 10°C.*

[2] *Store above 4°C.*

[3] *DF Formulation packaged in water soluble film should not be moved while frozen.*

[4] *Store above 10°C.*

[5] *Liquid ammonium sulfate in the "Poast Power Pack" cannot be frozen.*

* *Mention of a Brand or Trade name in this table does not constitute a guarantee or warranty of the product by the Ontario Weed Committee. Neither does this use signify that these products are approved to the exclusion of comparable products. All Trade names are capitalized.*

** *Symbols used are:*
DF = dry flowable;
EC = emulsifiable concentrate;
EM = emulsion;
Fl = flowable;
Gr = granular;
Li = liquid;
P = paste
PE = pellets;
PS = pressurized spray;
SC = soluble concentrate;
SG = soluble granules;
Sn = solution;
SP = soluble powder;
Su = suspension (flowable);
WG = wettable granules;
WP = wettable powder.

*** *Various manufacturers.*

WINTER STORAGE

A - Do not allow to freeze.

B - Preferably should not freeze. If frozen, return to original state by allowing product to warm to 10-20°C and agitate thoroughly before use.

C - Not usually damaged by freezing. Store in a cool, dry place. EC and Sn formulations in this group are stable to -18°C. DF formulations packaged in watersoluble film should not be moved while frozen.

READ STORAGE SECTION IN THE BACK OF THIS PUBLICATION!

Ontario Classification Schedule

Listed below are the Schedules in which the Brand Name products listed in Table 1 are classified under the Pesticides Act.

Explanation of Schedules

Schedule 1 - Restricted. Use permit only.
Schedule 2 - Restricted to agriculturists, licenced exterminators, registered custom sprayers and permit holders.
Schedule 3 - May be available for "Domestic" products only.
Schedule 4 - "Domestic" products only.
Schedule 5 - Limited to application on agricultural land.
Schedule 6 - Similar to Schedule 4 but may be registred for agricultural/commercial use.

For further information on the regulatory aspects of the classification please contact the Ministry of the Environment office nearest you.

Annual use permit required.

Herbicide Manufacturers

BASF	Basf Canada Inc.
CHIP	ICI Chipman
CYAN	Cyanamid Canada Inc.
DWEL	DowElanco Canada Inc.
GRBC	Great Lakes Biochemical Co.
HILL	Hillview Farms
MONS	Monsanto Canada Inc.
PPG	Pittsburg Paint & Glass
ROHM	Rohm & Haas Canada Inc.
SANX	Sanex
UAP	United Agri Products Canada
UNIR	Uniroyal Chemical
WECO	Wilbur-Ellis Company of Canada
CHEM	Chemagro Ltd.
CIBA	Ciba-Geigy Canada Ltd.
DUPO	Dupon Canada Inc.
FERM	Fermenta, ASC.
GREE	Green Cross
HOEC	Hoechst Canada Inc.
NORA	Nor-Am Chemical Co.
RHON	Rhone-Poulenc Canada Inc.
SAND	Sandoz Agro Canada Inc.
SHAM	Shamrock Chemicals
UCO	United Co-Operatives of Ontario
VWR	Vanwaters & Rogers
WILS	Wilson

NOTES ON CHEMICALS

These notes should be considered with the recommendations given later in this publication. Additional information on use, toxicity and safety precautions is given here. With a few exceptions the chemicals are listed under their common (generic) rather than their trade or product name. See Table 1 to determine the corresponding common name for a particular trade name. For example, Table 1 indicated that the trade name AATREX has a common name of atrazine; notes on AATREX will be listed under atrazine in this section.

2,4-D. TRADE NAMES: AQUA-KLEEN, DESORMONE, 2,4-D (EMULSIFIABLE CONCENTRATE), ESTEMINE. CHEMICAL FAMILY: Phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Cereals, turf, pastures, non crop land, asparagus, raspberries, strawberries, water weeds and brush. SENSITIVE WEEDS: Most broadleaf weeds, brush, Eurasian water milfoil, coontail, bladderwort, water lily and water shield. UPTAKE AND TRANSLOCATION: Readily absorbed through leaves or roots. Translocated primarily in phloem with the sugars but can also move with water in the xylem. Accumulation is primarily in the young rapidly growing meristematic regions of roots or shoots. BASIS OF SELECTIVITY: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites lead to greater activity on broadleaf weeds compared to grasses. APPLICATION METHODS: Postemergence (broadleaf weeds), stem-foliage or stem-basal (brush). RESIDUAL ACTIVITY: Half-life in soil is usually not longer than 1 or 2 weeks during the growing season due to rapid decomposition by soil microorganisms. UNIQUE CHARACTERISTICS: All weeds are more easily killed when growing rapidly in moist soil. Unfortunately some broadleaf crops, garden and ornamental plants are as sensitive to 2,4-D as many weeds and only a trace of the chemical as spray drift, vapor drift or contaminant in soil or water may cause serious damage. Even crops that can be sprayed safely can be sensitive at some stages of growth or at excessive application rates; thus label precautions should be followed carefully. Amines and esters are the most common formulations of 2,4-D. The esters are the most active and can be used at the lower rates and for brush control. Since vapor drift is a potential problem with the ester formulations, only the amines should be used on lawns, or near gardens or susceptible crop areas. Low volatile esters can be used by agriculturalists or licenced applicators in areas where risk of damage to sensitive non target vegetation is low. Recommendations are on the basis of acid equivalent, commercial products differ in their content of acid equivalent and this must be considered in determining the amount of product to use.

2,4-D/ DICAMBA/ MECOPROP. TRADE NAMES: KILLEX, KILLEX SUMMER FORMULA, KILLEX 500, KILMOR, PAR III, TRICEP. CHEMICAL FAMILY: Phenoxy/benzoic acid/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: BANVEL 3 and KILMOR for spring wheat, winter wheat, barley, corn, oats, non crop land; KILLEX, TRICEP and PAR III for turf. SENSITIVE WEEDS: At field crop rates - wild buckwheat, lady's-thumb, green smartweed, Russian thistle, sow-thistle, hedge bindweed, corn spurry, knotweed, volunteer cultivated buckwheat, common ragweed, cocklebur, stinkweed, mustards, prostrate pigweed, redroot pigweed and lamb's-quarters. At non crop land rates - a wide range of broadleaf weeds including bull thistle, chicory, goat's-beard, ragwort, white cockle, poison-ivy, alder and sheep-laurel. APPLICATION METHODS: Postemergence when weeds are small and actively growing; see crop recommendations for specific timing. UNIQUE CHARACTERISTICS: This mixture controls a wider spectrum of weeds than any of the herbicides alone.

2,4-DB. TRADE NAMES: COBUTOX, EMBUTOX 625, 2,4-D BUTYRIC. CHEMICAL FAMILY: Phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Seedling alfalfa, bird's-foot trefoil, clovers (except sweet) direct seeded or underseeded in spring wheat, barley or oats; corn. SENSITIVE WEEDS: Many small broadleaf weeds such as stinkweed, ragweed, lamb's-quarters, wild buckwheat and mustards. Top growth control of Canada thistle, field bindweed and perennial sow-thistle. UPTAKE AND TRANSLOCATION: Absorbed through the foliage and readily translocated to the growing points. BASIS OF SELECTIVITY: Sensitive weeds rapidly convert 2,4-DB into 2,4-D; tolerant species do not make this conversion under normal conditions. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: Mustards are not usually controlled by 2,4-DB alone if sprayed beyond the 4 leaf stage; a tank mixture with MCPA will improve control of these larger mustards. Injury to alfalfa increases under drought stress, or when alfalfa seedlings have more than 4 leaves.

ADJUVANTS. (See AGRAL 90, ASSIST OIL CONCENTRATE, BIVERT PH, COMPANION, CANPLUS 441, CORNOIL, CORNOIL CONCENTRATE, CITOWETT PLUS, DEFOAMERS, DRIFT CONTROL AGENTS, ENHANCE, FRIGATE, HALT, KORNOIL, KORNOIL CONCENTRATE, LO-DRIFT, MERGE, MINERAL OIL [NON-HERBICIDAL], MINERAL OIL/SURFACTANT [NON-HERBICIDAL], NALCO-TROL, SPRAY ADJUVANT DEFOAMER, SURFACTANTS).

AG-SURF. TYPE OF ADJUVANT: Non-ionic surfactant. CHEMICAL COMPOSITION: Nonylphenoxy polyethyoxyethanol 92%. REGISTERED USES: For use with chlorsulfuron. BENEFIT: Improves chemical effectiveness. MODE OF ACTION: It is a wetting and spreading agent which improves coverage of spray mixtures. MIXING: For control of annual grasses and broadleaf weeds with glyphosate use 350 mL in spray volumes not greater than 110 L water per hectare as specified on the label. With chlorsulfuron use 100 mL per 100 L of spray solution. An antifoaming agent may be required to reduce foaming. UNIQUE CHARACTERISTICS: Do not exceed recommended rates of Ag-Surf,

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

as too much may reduce the effectiveness of the herbicide due to excessive runoff.

AGRAL 90. TYPE OF ADJUVANT: Non-ionic surfactant. CHEMICAL COMPOSITION: Nonylphenoxy polyethyoxyethanol 90%. REGISTERED USES: For use with diquat, fluazifop-butyl and paraquat, and for washing sprayer tanks and equipment. BENEFIT: Improves chemical effectiveness. MODE OF ACTION: It is a wetting and spreading agent which improves coverage of spray mixes. MIXING: Use 250-1000 mL per 1000 L of spray as specified on label. Will mix with all types of water. Add AGRAL 90 to the spray mixture and agitate thoroughly. UNIQUE CHARACTERISTICS: Do not exceed the recommended rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive runoff.

AMITROLE. TRADE NAME: AMITROL-T CHEMICAL FAMILY: Triazole. CROP AND/OR NON-CROP REGISTRATIONS: Preplant in corn, soybeans and white beans. Post harvest in corn, soybeans, white beans, grain, peas, alfalfa and clover. In season weed control in apples. Shelterbelts. Non crop areas. Marshes and ditches. Spot treatment in pastures. SENSITIVE WEEDS: Many annual and perennial broadleaf weeds and grasses including quack grass, Canada thistle, sow-thistle, poison-ivy, poison-oak, toadflax, milkweed, hoary cress, leafy spurge, horsetail, cattail, honeysuckle, locust, ash and sumac. UPTAKE AND TRANSLOCATION: Absorbed by foliage and roots. Translocates well in xylem and phloem. Accumulates in growing regions of plant.. BASIS OF SELECTIVITY: Resistant plants metabolize amitrole more rapidly than sensitive plants and may have lower uptake as a result of leaf structure which reduces wetting and penetration. APPLICATION METHODS: Foliar postemergence application to actively growing plants. Good coverage is essential. If weeds are mature, it is advisable to cut them and then spray the regrowth. Do not disturb treated plants for at least two weeks after application. Do not make postharvest application after October 1. For control of quack grass and Canada thistle apply in spring or fall to actively growing plants 15-20 cm tall: wait 10-14 days and then plow or disk. RESIDUAL ACTIVITY: Approximately two to four weeks in moist, warm soil. UNIQUE CHARACTERISTICS: Most crops are sensitive if contacted. Poor results may occur: if spray coverage is inadequate, if plants are drought stressed or overmature, or if heavy rains fall within 12 hours after application. Do not graze or plant to grain, peas, alfalfa or clover for 8 months after treatment. Do not graze spot treated areas in pastures for 6 months following treatment. In AMITROL-T, the addition of ammonium thiocyanate as a synergist improves control of some weed species.

AMMONIUM SULPHAMATE. TRADE NAME: POISON IVY & BRUSH KILLER CHEMICAL FAMILY: Ammonium sulfamate CROP AND/OR NON-CROP REGISTRATIONS: Used in non crop land for the elimination of weeds and small brush, and as a stump treatment to prevent resprouting. SENSITIVE WEEDS: Most woody plants, grasses and herbaceous broadleaf weeds including poison-ivy. UPTAKE AND TRANSLOCATION: Rapidly absorbed through foliage and green stems as well as through freshly cut wood surfaces. Translocation has been demonstrated in woody and herbaceous plants. BASIS OF SELECTIVITY: Non-selective. APPLICATION METHODS: Applied as foliar spray or as a concentrated solution to cut woody surfaces. RESIDUAL ACTIVITY: Herbicidal activity in soil does not normally persist longer than 6 to 8 weeks. UNIQUE CHARACTERISTICS: Non flammable, non volatile but corrosive to equipment. Wash equipment thoroughly after use and avoid prolonged contact with the skin.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

AMMONIUM SULPHATE. TYPE OF ADJUVANT: Liquid fertilizer. CHEMICAL COMPOSITION: 490 grams/litre ammonium sulphate in water. REGISTERED USES: BASF LIQUID AMMONIUM SULPHATE is registered for use with POAST on various crops and BASAGRAN in soybeans only. BENEFIT: Improved and more consistant control of weeds under varying environmental conditions with POAST (wild oats, volunteer cereals and quackgrass) or BASAGRAN (velvetleaf and lambs-quarters). MODE OF ACTION: Improved uptake of herbicide related to spray or droplet characteristics. MIXING: Half fill spray tank with water and agitate continuously, add LIQUID AMMONIUM SULPHATE followed by POAST or BASAGRAN, continue to fill spray tank and add ASSIST oil concentrate last. UNIQUE CHARACTERISTICS: Liquid ammonium sulphate is extremely corrosive to metals, therefore, all metal sprayer parts coming into contact with the spray solution should be checked regularly. Metal spray tips will be subject to corrosion, so the sprayer should be calibrated regularly during the season and tips replaced when necessary.

AQUASHADE. CHEMICAL FAMILY: Water soluble dyes. CROP AND/OR NON-CROP REGISTRATIONS: Contained golf course, farm and industrial ponds, fountains and aquariums. SENSITIVE WEEDS: Filamentous algae and certain aquatic weeds. UPTAKE AND TRANSLOCATION: The dye filters wavelengths of sunlight reducing the light intensity. APPLICATION METHODS: May be added in a concentrated form from the shoreline or diluted form for larger areas. It is recommeded to make the application early in the growing season before algae and weed growth develops. Mechanical removal of heavy vegetation is recommeded before applying Aquashade if fish are present in the pond. RESIDUAL ACTIVITY: The effect lasts as long as the water keeps its blue color. Additional Aquashade can be applied when the color of the water fades or when the first new algae and weed growth is noticed. UNIQUE CHARACTERISTICS: It has no direct chemical action, and will therefore not harm fish.

ASSIST OIL CONCENTRATE. TYPE OF ADJUVANT: Mineral oil/surfactant (non-herbicidal). CHEMI-

CAL COMPOSITION: 83% paraffin base mineral oil plus 17% surfactant blend. REGISTERED USES: ASSIST OIL CONCENTRATE is registered for use with POAST, BASAGRAN, LADDOK and atrazine. BENEFIT: The use of ASSIST results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. ASSIST will also aid in providing a faster weed kill. MODE OF ACTION: Reduces the evaporation of spray droplets on the leaf surface leading to a longer period for penetration. Improves penetration through the leaf cuticle layer. ASSIST also aids in spreading a spray droplet on the leaf surface so that it covers a greater surface area. MIXING: Fill the spray tank half full with water and begin agitation. Add the desired amount of herbicide and continue filling. Add ASSIST last. After filling, continue agitation. Agitate thoroughly after any stoppage in spraying. UNIQUE CHARACTERISTICS: May cause increased temporary topical burn to crop plants under hot, humid weather conditions.

ATRAZINE. TRADE NAMES: AATREX, AATREX NINE-O, AATREX-PLUS, ATRA-MIX, ATRAZINE 90W, ATRAZINE 80W, ATRAZINE FLOWABLE, ATRAZINE 500, ATRAZINE 480. CHEMICAL FAMILY: S-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field, seed and sweet), low bush blueberries, and triazine-tolerant canola (rapeseed). SENSITIVE WEEDS: will control a wide range of broadleaf weeds such as mustards, purslane, ragweed, smartweed, lady's-thumb, wild buckwheat, lamb's-quarters, pigweed and volunteer clover. Populations of lamb's-quarters, pigweed and ragweed have been found which are resistant to atrazine and are therefore not controlled. UPTAKE AND TRANSLOCATION: Actively absorbed by roots and foliage, although foliar absorption is usually small. It is translocated to the top of the plant and accumulates in the leaf margins and the growing points. BASIS OF SELECTIVITY: Metabolism by tolerant species. Spray timing avoids contact with low bush blueberries to prevent injury. APPLICATION METHODS: For corn, preplant incorporated, preemergence, or postemergence (with or without oil) usually before the annual weeds are more than 4 cm high; under dry weather conditions a shallow incorporation may enhance activity; oil or oil/surfactant blends will increase the postemergence activity. For low bush blueberries, preemergence application. For triazine-tolerant canola, postemergence. Dry bulk fertilizer may be impregnated with atrazine and applied preplant incorporated. Atrazine may be tank mixed with several other annual grass and broadleaf herbicides to increase the spectrum of weed control in corn. RESIDUAL ACTIVITY: Can persist in the soil for varying lengths of time depending on rate, weather and soil conditions (longer under dry, cool weather conditions and in sandy soils). Postemergence treatments tend to persist longer than preemergence treatments. See section "Special Notes for CORN". UNIQUE CHARACTERISTICS: Atrazine may carry over for more than one planting season. One year after application there is usually no hazard to most rotational crops when 1.5 kg ai/ha or less is applied. Cool, dry weather and sandy soils are conditions under which problems may arise. See "Notes on atrazine and simazine soil residues" in "Special Notes for CORN".

ATRAZINE/ SIMAZINE. TRADE NAME: EKKO CHEMICAL FAMILY: S-triazine/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: EKKO for corn (ensilage, field, seed and sweet). SENSITIVE WEEDS: At the rates used on corn the following are controlled: mustards, ragweed, lady's-thumb, lamb's-quarters, purslane, smartweed, wild buckwheat, redroot pigweed, barnyard grass, yellow foxtail, green foxtail, witch grass, wild oats, crab grass; perennial weeds such as quack grass, Canada Thistle and nutsedge can be controlled with split applications - see product label for specifics and precautions. UPTAKE AND TRANSLOCATION: Absorbed by roots and foliage, although foliar absorption is usually small. It is translocated to the top of the plant and accumulates in the leaf margins. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: For corn: preplant incorporated, preemergence or postemergence with oil; preplant incorporation must be shallow with a harrow or cultivator as a disc usually incorporates too deep; rainfall is required to activate a preemergence application; postemergence applications must be made in an oil-water emulsion when grasses are in the 1 to 2 leaf stage and broadleaves are no higher than 10 cm. For non crop land: preemergence and postemergence. RESIDUAL ACTIVITY: At rates recommended for corn, crops other than corn should not be planted for at least one year; two years after application, most rotational crops can be planted except for tobacco which should not be planted within 3 years. UNIQUE CHARACTERISTICS: Triazine-resistant weed species will not be controlled. Where crab grass exists in corn in heavy populations, a cultivation will be necessary. Atrazine/simazine is not recommended for muck soils. Since atrazine/simazine has a long residual period, corn must follow corn for at least one year. See the product label for specific instructions with respect to carryover. Uneven application (overlapping, etc) may result in even longer carryover. Do not apply to frozen or snow covered ground.

BENSULIDE. TRADE NAMES: BETASAN, PREFAR. CHEMICAL FAMILY: Benzenesulfonamide. CROP AND/OR NON-CROP REGISTRATIONS: BETASAN for lawns and turf. PREFAR for cucumbers. SENSITIVE WEEDS: Germinating annual grasses such as annual blue grass, barnyard grass, crab grass, and foxtail. Some control of redroot pigweed, lamb's-quarters and shepherd's-purse. UPTAKE AND TRANSLOCATION: Adsorbed on root surfaces and a small amount is absorbed by the roots. Little or none is translocated upward to the leaves. BASIS OF SELECTIVITY: Inhibits root growth and partially inhibits cell division in sensitive seedlings. Sensitive species affected only in seedling stage. Metabolized by established grasses. APPLICATION METHODS: Preemergence in spring or fall for turf

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

(well established only); a higher rate is required for fall applications to control germinating weeds the following spring; incorporate by lightly irrigating into soil. Preplant incorporated for cucumbers (on mineral soil only); incorporate to 3-5 cm depth; it may also be applied preemergence if incorporated by sprinkler or furrow irrigation. RESIDUAL ACTIVITY: Season long weed control. Degraded slowly by soil microorganisms with a half life of 4-6 months depending on soil type. Because of soil residues, only cucurbits, cole crops, carrots, lettuce, peppers and tomatoes should be planted the following year. UNIQUE CHARACTERISTICS: Bensulide is inactivated in soils containing high amounts of organic matter (muck soils). Incorporation recommended to avoid photodecomposition. PREFAR may also be tank mixed with naptalam and applied preplant incorporated in cucumbers for broad spectrum control of germinating annual broadleaf and grassy weeds. Do not reseed lawn within one year of application. Formulations available with fertilizers for homeowner lawn use.

BENTAZON. TRADE NAME: BASAGRAN CHEMICAL FAMILY: Benzothiadiazine. CROP AND/OR NON-CROP REGISTRATIONS: Peas, flax, soybeans, dry and snap beans, lima beans, faba beans, peanuts, corn and turf. SENSITIVE WEEDS: Annual broadleaf weeds including hairy nightshade, lamb's-quarters*, redroot pigweed*, low cudweed, purslane, common ragweed*, wild radish, Russian thistle, hairy galinsoga, corn spurry, bird rape, flower-of-an-hour, buttercups, common groundsel*, jimsonweed, giant ragweed, velvetleaf, lady's-thumb, wild mustard, cocklebur, stinkweed, shepherd's-purse and common chickweed. (*Triazine-tolerant biotypes of these weeds are also controlled). Top growth of Canada thistle and nutsedge. Field bindweed may be suppressed by two applications applied 10 days apart. UPTAKE AND TRANSLOCATION: Taken up through the foliage. Not translocated. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Postemergence when weeds are small and actively growing. Apply in 100-400 L water/ha. Crop must be in a tolerant growth stage (see specific recommendations and label). Thorough spray coverage is necessary. Use flat-fan nozzles tilted 45° forward. Use ASSIST OIL CONCENTRATE with BASAGRAN. The ASSIST rate should be reduced under hot, humid conditions. CITOWETT PLUS may replace ASSIST on peas. Liquid ammonium sulphate or 28% urea ammonium nitrate may be added to BASAGRAN for improved and more consistent control of velvetleaf and lamb's-quarters in soybeans only. PINNACLE may be tank mixed with BASAGRAN for improved pigweed and lamb's-quarters control in soybeans only. BASAGRAN is registered for aircraft application for soybeans, dry and snap beans. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: Corn and turf are tolerant at all stages of growth. Bentazon is not volatile. Temporary crop injury can be expected if bentazon is applied during hot, humid weather or if crop is stressed (flooding, drought, cold). Cool weather or drought may delay control. Rainfall within 6 to 8 hours after application may reduce effectiveness. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

BENTAZON/ ATRAZINE. TRADE NAME: LADDOK CHEMICAL FAMILY: Benzothiadiazine/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field, seed and sweet). SENSITIVE WEEDS: Annual broadleaf weeds such as black nightshade, redroot pigweed, lamb'squarters, low cudweed, purslane, common ragweed, Russian thistle, corn spurry, flower-of-an-hour, lady's-thumb, wild mustard, hairy galinsoga, bird rape, buttercup, common chickweed, common groundsel, jimsonweed, giant ragweed, velvetleaf and cocklebur. Triazine-tolerant biotypes are also controlled. Top growth of Canada thistle and nutsedge are controlled. Field bindweed may be suppressed. UPTAKE AND TRANSLOCATION: Uptake into the plant occurs primarily through the leaves. Bentazon/atrazine has mainly contact action and translocation is minimal. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Bentazon/atrazine should be applied early postemergence when weeds are small and actively growing. Apply in 200-400 L water/ha. Application should be made before weeds reach the maximum size listed on the label. This generally corresponds to corn in the 1 to 5 leaf stage. Under good growing conditions, the most effective time for spraying will usually be 18 to 28 days after planting. ASSIST OIL CONCENTRATE should be added to the spray tank for all applications. Thorough spray coverage is important and flat fan nozzles should be used. The use of flood-jet nozzles is not recommended because of inadequate coverage. RESIDUAL ACTIVITY: Injury may occur to any crop other than corn planted in the same season on land treated with bentazon/atrazine. In the season after application, there is virtually no hazard to most rotational crops when label rates for annual weed control have been used. Overlap or the use of a double application for nutsedge control may result in injury to rotational crops due to carryover of the atrazine component of bentazon/atrazine. UNIQUE CHARACTERISTICS: Corn is tolerant at all stages of growth. Rainfall within 6 to 8 hours of application may reduce effectiveness of the spray solution. Bentazon/atrazine is not volatile but it should not be applied when crop is under stress from prolonged cold, wet weather, poor fertility, or other factors.

BIVERT PH. TYPE OF ADJUVANT: Drift control agent. CHEMICAL COMPOSITION: Dimethylalkyl amine. REGISTERED USES: In combination with phenoxy herbicides for roadsides and rights-of-way (non crop). BENEFIT: Drift control. MODE OF ACTION: When combined with fuel oil, constitutes the oil phase in a bifluid system to produce a thick water-in-oil (invert) emulsion. MIXING: Special bifluid apparatus required. Follow manufacturer's instructions. UNIQUE CHARACTERISTICS: A closed system is required to maintain a mayonnaise type consistency. The presence of air in the suction lines will cause the invert to collapse.

BROMACIL. TRADE NAMES: HYVAR X, HYVAR X-L. CHEMICAL FAMILY: Uracil. CROP AND/OR NON-CROP REGISTRATIONS: Non crop land for total vegetation control and as a spot treatment to control brush. SENSITIVE WEEDS: Annual and perennial broadleaved weeds and grasses (broadcast application). Several brush species (spot application). UPTAKE AND TRANSLOCATION: Most readily absorbed through the roots. Surfactants can enhance foliar activity. Translocation is upward with the movement of water to leaves where it inhibits photosynthesis. BASIS OF SELECTIVITY: Non selective at normal rates. APPLICATION METHODS: For herbaceous weeds, broadcast sprayed, preferably just before or during periods of active weed growth. For brush, spot applications with an exact delivery handgun either at the base of target brush or on a grid. RESIDUAL ACTIVITY: Half-life was 5-6 months for 4.4 kg/ha bromacil in a silty loam soil. UNIQUE CHARACTERISTICS: Bromacil should not be used where it is likely to leach, wash or move with eroded soil into contact with the roots of desirable trees and shrubs. Do not apply to brush standing in water.

BROMACIL/ 2,4-D. TRADE NAME: CALMIX PELLETS CHEMICAL FAMILY: Uracil/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Non crop land. SENSITIVE WEEDS: Annual and perennial broadleaved weeds and grasses. BASIS OF SELECTIVITY: Non selective. APPLICATION METHODS: Spread dry, by hand application or Calmix spreader. UNIQUE CHARACTERISTICS: Combination of foliar and root uptake on broadleaf weeds providing faster and longer lasting weed control than either chemical alone. Also see notes on bromacil and 2,4-D.

BROMACIL/ DIURON. TRADE NAME: KROVAR CHEMICAL FAMILY: Uracil/substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Non crop land. SENSITIVE WEEDS: Most herbaceous weeds. BASIS OF SELECTIVITY: Non selective. APPLICATION METHODS: Broadcast sprayed just before or during the period of active weed growth. UNIQUE CHARACTERISTICS: Normally fewer species of weeds escape or regrow after use of this mixture compared to use of the same amount of either chemical alone. Also see notes on bromacil and diuron.

BROMOXYNIL. TRADE NAME: PARDNER CHEMICAL FAMILY: Hydroxybenzonitrile. CROP AND/OR NON-CROP REGISTRATIONS: Spring wheat, barley, oats, corn, fall rye, triticale and many other grasses. SENSITIVE WEEDS: Wild buckwheat, smartweed, lamb's-quarters and wild mustard are killed if the chemical thoroughly contacts these plants before they have more than 4 true leaves. Most established perennial broadleaf weeds, chickweed and grasses tolerate field applications of this herbicide. UPTAKE AND TRANSLOCATION: Absorbed by plant foliage and moves very little within the plant. BASIS OF SELECTIVITY: Differential spray retention, uptake, translocation and degradation. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Essentially no soil residual activity. UNIQUE CHARACTERISTICS: Crop injury symptoms (leaf scorch) may develop if the plant is under stress within 2 or 3 days before or after spraying; this stress could be caused by high temperatures or high humidity or, in the case of corn, application following a period of cool, wet weather; such injury usually does not affect yields. The formulation includes a wetting agent to improve the spread of droplets on the leaf. Although bromoxynil is not an effective soil applied herbicide, broadleaf crops such as turnips, peas and beans should not be seeded for a week after spray application.

BROMOXYNIL/ MCPA. TRADE NAMES: BUCTRIL M, BROMOX 720M. CHEMICAL FAMILY: Hydroxybenzonitrile/phonoxy. CROP AND/OR NON-CROP REGISTRATIONS: Spring and winter wheat, barley, oats, flax, fall rye, corn and canary grass. UNIQUE CHARACTERISTICS: Combination of bromoxynil with MCPA provides better control of mustards than bromoxynil alone. Also see notes on bromoxynil and MCPA.

BUTYLATE/ ATRAZINE. TRADE NAME: SUTAZINE+ CHEMICAL FAMILY: Thiocarbamate/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field and sweet). SENSITIVE WEEDS: Many annual weeds such as: barnyard grass, crab grass, fall panicum, green foxtail, yellow foxtail, wild oats, witch grass, lady's-thumb, lamb's-quarters, mustards, purslane, ragweed, redroot pigweed, smartweed and velvetleaf; also yellow nutsedge. UPTAKE AND TRANSLOCATION: Uptake by underground plant parts (root, hypocotyl and seed), then translocated upward to growing tip and leaf margins. BASIS OF SELECTIVITY: Metabolism by tolerant species at the seed-germination stage. R25788 enhances enzymatic breakdown of butylate in tolerant species. APPLICATION METHODS: May be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced dealers. To prevent chemical loss and reduced weed control, butylate/atrazine should be uniformly incorporated in the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep, followed by a levelling device. When application and incorporation are done in separate operations, application should be to a dry soil surface and incorporation should be within 4 hours for liquid application or within the same day when impregnated on dry fertilizer. RESIDUAL ACTIVITY: Provides season long weed control. Fall tillage will minimize risk of atrazine injury to spring planted crop. Soybeans and white beans may be planted the following spring. UNIQUE CHARACTERISTICS: Atrazine

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

carryover may result in a dry year. Will not control triazine-resistant weeds.

BUTYLATE/ R25788 (BUTYLATE^{+}). TRADE NAME: SUTAN+ CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field and sweet). SENSITIVE WEEDS: Annual grasses such as wild oats, crab grass, barnyard grass, green foxtail, yellow foxtail, witch grass, and fall panicum; also yellow nutsedge. UPTAKE AND TRANSLOCATION: Uptake and underground plant parts (roots, hypocotyl and seed), then upward translocation to the growing tip. BASIS OF SELECTIVITY: Metabolized by tolerant species at the seed germination stage. R25788 enhances the enzymatic breakdown of the herbicide in tolerant species. Seed food reserves permit seedling to outgrow chemical effect. APPLICATION METHODS: May be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, butylate/R25788 should be uniformly incorporated in the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be to a dry soil surface and incorporation should be within 4 hours for liquid application or within the same day when impregnated on dry fertilizer. RESIDUAL ACTIVITY: Provides season long weed control with no soil residues the following year to prevent crop rotation. In tank mix combinations with atrazine, there may be atrazine residues with the highest atrazine rate is used. UNIQUE CHARACTERISTICS: Does not need rainfall to be activated and will not leach significantly under heavy rainfall. This herbicide may be successfully tank mixed with triazine herbicides (atrazine or cyanazine) for excellent broad spectrum broadleaf and grass control.

CANPLUS 411. TYPE OF ADJUVANT: Mineral oil/surfactant (non herbicidal). CHEMICAL COMPOSITION: 83% paraffin base mineral oil plus 17% surfactant blend. REGISTERED USES: CANPLUS 411 is registered for use with ASSURE. BENEFIT: The use of CANPLUS 411 results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. MODE OF ACTION: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets thus improving the penetration through the cuticle of leaf surfaces. MIXING: Add the required amount of water to spray tank with agitator running. Add ASSURE and after well mixed add 5-10 litres of CANPLUS 411 for each 1000 litres of spray solution. UNIQUE CHARACTERISTICS: May cause increased temporary phytotoxicity to crop plants under hot humid weather conditions.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

CHLORAMBEN. TRADE NAME: AMIBEN GARDEN WEED PREVENTER. CHEMICAL FAMILY: Benzoic Acid. CROP AND/OR NON-CROP REGISTRATIONS: Asparagus, carrots, dry beans, kidney beans, lima beans, transplanted peppers, pumpkins, snapbeans, soybeans, squash, sunflowers, transplanted tomatoes, white beans, woody nursery stock, iris, gladioli and annual flowers. SENSITIVE WEEDS: Annual broadleaf weeds including chickweed, lamb's-quarters, pigweed, ragweed, smartweed and velvetleaf. Annual grasses including barnyard grass, large crab grass, smooth crab grass, green foxtail and yellow foxtail. UPTAKE AND TRANSLOCATION: Primarily taken up through roots, emerging shoots or coleoptile/hypocotyl. BASIS OF SELECTIVITY: Tolerant species form inactivated conjugates (glucose-chloramben conjugate) more rapidly than do susceptible species. Limited foliar absorption and translocation. APPLICATION METHODS: Preplant incorporated, preemergence and postemergence. For preplant incorporated the chemical should be incorporated in the top 0-5 cm of the soil using most forms of secondary tillage equipment; incorporation should be completed with two passes of the tillage equipment at right angles. RESIDUAL ACTIVITY: 6 to 8 weeks in soil. UNIQUE CHARACTERISTICS: When applied preemergence, chloramben requires rainfall to be activated; if sufficient rainfall does not fall within 7 days after spraying chloramben, but there is enough moisture to germinate weeds and grasses, a light cultivation with a rotary hoe will uproot these small weeds and incorporate the herbicide into the germinating weed seed zone.

CHLORPROPHAM. TRADE NAME: CIPC EC, CIPC GR. CIPC. CHEMICAL FAMILY: Phenylcarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Carrots, lettuce, onions, spinach, daffodils, gladioli, iris, tulips and ornamental nursery stock. SENSITIVE WEEDS: Annual broadleaf and grass weeds including purslane, chickweed, smartweed, carpetweed, false flax, annual bluegrass, crab grass, rye grass, stink grass and dodder. UPTAKE AND TRANSLOCATION: Readily translocated to the leaves following root absorption. Vapors have been demonstrated to be absorbed by seeds and emerged dodder. BASIS OF SELECTIVITY: Rapid degradation in tolerant plants as well as soil adsorption. APPLICATION METHODS: Preemergence and directed postemergence in specified crops. RESIDUAL ACTIVITY: Tightly bound to soil colloids. The rate of dissipation can vary greatly with microbial activity and moisture level. Both high soil temperature and excessive soil moisture increase the rate of dissipation. UNIQUE CHARACTERISTICS: Use the lower rates on sandy or coarse textured soils and the higher rates on clay or muck soils. Weed control is most effective when soil temperatures are below 16°C. The lower rate should be used when soil temperature is below 16°C. The soil must be moist for effective weed control.

CHLORSULFURON. TRADE NAME: GLEAN CHEMICAL FAMILY: Sulfonyl urea. CROP AND/OR

NON-CROP REGISTRATIONS: Non crop land. SENSITIVE WEEDS: Annual and perennial broadleaf weeds such as wild carrot, Canada thistle, sow-thistle, scentless chamomile, lamb's-quarters, wild mustard, redroot pigweed, stinkweed, cow cockle, chickweed and Russian thistle. UPTAKE AND TRANSLOCATION: Thoroughly systemic after absorption of either foliage or roots. Foliar absorption is rapid. BASIS OF SELECTIVITY: A disruption of amino acid metabolism leads to an inhibition of cell division in sensitive plants. Faster rates of metabolic detoxification have been observed in tolerant species. APPLICATION METHODS: Preemergence or early postemergence. RESIDUAL ACTIVITY: Half-life is 4-6 weeks under growing season conditions. Degradation is faster with higher soil temperatures and/or lower soil pH. UNIQUE CHARACTERISTICS: Although degradation is moderately rapid, extremely low residues can be highly toxic to some broadleaf weeds, such as wild carrot, for up to 2 years after application. Use of this product requires a surfactant.

CHLORTHAL DIMETHYL. TRADE NAMES: DACTHAL, DACTHAL WP, DACTHAL GR. CHEMICAL FAMILY: Phthalate. CROP AND/OR NON-CROP REGISTRATIONS: Broccoli, Brussels sprouts, cabbage, cauliflower, dry and snap beans, eggplant, established ornamentals, field beans, garlic, lawns and turf, onions, peppers, potatoes, seeded melons, soybeans, strawberries, sweet potatoes, tomatoes, gladioli and woody nursery stock. SENSITIVE WEEDS: Germinating annual grasses and certain annual broadleaf weeds such as lamb's-quarters, purslane, common chickweed, redroot pigweed, carpetweed and ground-cherry. UPTAKE AND TRANSLOCATION: Absorbed by roots but not foliage. No translocation within plant. BASIS OF SELECTIVITY: Inhibits growth of germinating seeds; exact mechanism not yet known. APPLICATION METHODS: Must be applied prior to weed seed germination. Depending on the crop, may be applied preplant incorporated, preemergence, postemergence or post transplant to crop. At least 1 cm of water as either rain or irrigation is necessary to activate the herbicide. In turf, spring or fall application is satisfactory. RESIDUAL ACTIVITY: Average half-life is 100 days in most general soil types. Effective weed control may be maintained for as long as 2 months, depending on application rate and soil type. UNIQUE CHARACTERISTICS: May be applied over the top of most plants with no phytotoxic effects. Little herbicidal activity against velvetleaf, common ragweed, mustards, jimsonweed, galinsoga, smartweed, nutsedge and cocklebur. Established turf grasses (with the possible exception of the bent grasses) have good tolerance. Lawns and turf should not be reseeded for 60 days after treatment. Use only on mineral soils.

CITOWETT PLUS. TYPE OF ADJUVANT: Non-ionic spreader sticker surfactant. CHEMICAL COMPOSITION: Octylphenoxypolyethoxy ethanol 50%. REGISTERED USES: Corn/atrazine; sugar beets and red beets/pyrazon; peas/bentazon. BENEFIT: Improves postemergence control of weeds which have reached their upper limit in size for susceptibility. MODE OF ACTION: Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast. MIXING: Fill tank about half full with water; add herbicide with continuous agitation; complete filling of tank with water; add CITOWETT with continuous agitation. UNIQUE CHARACTERISTICS: Higher rates are required with hard water.

CLOPYRALID. TRADE NAME: LONTREL CHEMICAL FAMILY: Pyridine. CROP AND/OR NON-CROP REGISTRATIONS: Strawberries. SENSITIVE WEEDS: Will control or suppress certain annual and perennial weeds including Canada thistle, goldenrod, ox-eye daisy, tufted vetch, sheep sorrel, dandelion and wild buckwheat. UPTAKE AND TRANSLOCATION: Rapidly absorbed by foliage. Translocation can be up or down but, like 2,4-D, accumulation is in young, rapidly growing meristematic tissue. BASIS OF SELECTIVITY: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species. APPLICATION METHODS: Postemergence and an overall spray.

COMPANION. TYPE OF ADJUVANT: Non-ionic surfactant. CHEMICAL COMPOSITION: Octylphenoxy-polyethoxy-(9)-ethanol 70%. REGISTERED USES: For use with chlorsulfuron. BENEFIT: Improves chemical effectiveness. MODE OF ACTION: It is a wetting and spreading agent which improves coverage of spray mixes. MIXING: For use with glyphosate for the control of annual grasses and broadleaf weeds, add 450 mL of COMPANION in 50 to 100 litres of water per hectare. With chlorsulfuron, add 100 mL of COMPANION to 100 litres of water for the control of broadleaf weeds. Use constant agitation. UNIQUE CHARACTERISTICS: Do not exceed the recommended rates of COMPANION as too much may reduce the effectivness of the herbicide due to excessive runoff.

COPPER CITRATE AND GLUCONATE. TRADE NAME: ALGIMYCIN PLL-C CHEMICAL FAMILY: Chelates of copper gluconate and copper citrate. CROP AND/OR NON-CROP REGISTRATIONS: Algae control in wholly enclosed farm, fish and fire ponds having no outflow beyond the property limits of the user. SENSITIVE WEEDS: Most algae including Spirogyra, Ulothrix, Cladophora, Chara and Nitella. UPTAKE AND TRANSLOCATION: No information available. BASIS OF SELECTIVITY: Non selective. APPLICATION METHODS: Available as a tablet or a liquid formulation. Apply early in the season where algae is well established and growing vigorously. Apply early in the day as sunlight enhances the effectiveness of the treatment. To ensure even distribution, apply tablet formulation with a hand scoop. Apply liquid directly onto floating mats of algae or inject below surface for algae growing on the bottom of the pond, with a small hand sprayer or backpack sprayer. To avoid oxygen depletion, treat 1/3 to 1/2 of the water area in a

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

single operation and wait at least 10 to 14 days between treatments. RESIDUAL ACTIVITY: One application of the tablet formulation of ALGIMYCIN should provide control over the entire year. When using liquid ALGIMYCIN, a second treatment or spot treatment later in the season may be required. UNIQUE CHARACTERISTICS: The tablet formulation is more effective than the liquid formulation for the control of Chara and Nitella. Not for use in public waters or waters that drain into public waters. Do not apply in deep waters. May be toxic to trout and other species of fish. Do not apply directly to crop plants, seedling grasses or non established ornamental plants, as injury may result. Not for use in potable water systems.

COPPER ETHANOLAMINE. TRADE NAME: CUTRINE PLUS. CHEMICAL FAMILY: Mixture of chelates of copper ethanolamines. CROP AND/OR NON-CROP REGISTRATIONS: Algae control in wholly enclosed farm, fish and fire ponds and fish hatcheries having no outflow beyond the property limits of the user. SENSITIVE WEEDS: Microcystis, Oscillatoria, Anabaena, Aphanizomenon, Spirogyra, Cladophora, Vaucheria, Ulothrix, Chara and Nitella. UPTAKE AND TRANSLOCATION: No information available. BASIS OF SELECTIVITY: Non selective. APPLICATION METHODS: Available as a granular or a liquid formulation. Apply early in the day as ample sunlight is required for maximum control. To ensure even distribution of the granular formulation, employ a scoop or dry fertilizer spreader. Use a hand or power sprayer for best distribution of the liquid formulation. To avoid oxygen depletion, treat only 1/3 to 1/2 of the pond at a time. Allow 1-2 weeks between treatments. RESIDUAL ACTIVITY: One application of granular CUTRINE-PLUS should provide control over the entire season. When using liquid CUTRINE-PLUS, a second treatment later in the season may be required. UNIQUE CHARACTERISTICS: Not for use in potable waters. Not for use in public waters or waters that drain into public waters. Extremely toxic to fish in soft waters; toxic in hard waters if the maximum recommended concentration is exceeded; if fish are present but water hardness is not known, do not use CUTRINE-PLUS. Treated areas may be used for swimming or fishing immediately after treatment. Water from treated pools may be used to irrigate turf, fairways, putting greens and ornamental plants.

CORNOIL. (See KORNOIL)

CORNOIL CONCENTRATE. (See KORNOIL CONCENTRATE)

CYANAZINE. TRADE NAMES: BLADEX LIQUID, BLADEX NINE-T. CHEMICAL FAMILY: S-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field and sweet), triazine-tolerant canola (rapeseed). SENSITIVE WEEDS: Annual nightshades, purslane, lady's-thumb, lamb's-quarters, prostrate knotweed, shepherd's-purse, wild buckwheat, wild mustard, wormseed mustard, velvetleaf, pigweed, crab grass, green foxtail, yellow foxtail, witch grass, fall panicum and barnyard grass. UPTAKE AND TRANSLOCATION: Readily absorbed by roots and foliage. When absorbed by roots it is translocated to the leaves. BASIS OF SELECTIVITY: Metabolism by tolerant crops. APPLICATION METHODS: Preplant incorporated in corn but only in mixtures with other corn herbicides; incorporation equipment should be set to work no deeper than 10 cm. Preemergence in corn; moisture is required for activation. Early postemergence in corn up to the 3 leaf stage (wettable granule). Early postemergence in triazine-tolerant canola (liquid formulation). RESIDUAL ACTIVITY: Cyanazine has a relatively short residual life in the soil; from normal spring applications there is no carryover of the herbicide to the next growing season. UNIQUE CHARACTERISTICS: Cyanazine is a short lived triazine herbicide with flexible application time. Preemergence applications do not adequately control barnyard grass, fall panicum or pigweed under conditions which delay germination such as low temperature or dry soil surface. Emerged velvetleaf will be controlled by the early postemergence application but subsequent germinating velvetleaf will not be controlled. Cynazine is not recommended alone for use on heavy clay soil. Do not use on peat, muck soils, sandy soils or soils with less than 1% organic matter. Do not use the liquid formulation postemergence in corn. Do not add oil or surfactants other than as specified on the label. Cyanazine may be used in tank mixes and has been formulated with various other herbicides. See label for specifications.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

CYANAZINE/ MCPA. TRADE NAME: BLAGAL. CHEMICAL FAMILY: S-triazine/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Spring wheat, barley, oats and mixed grain. SENSITIVE WEEDS: Tartary buckwheat, wild buckwheat, green smartweed, lady's-thumb, hemp-nettle, stinkweed, corn spurry, wild radish, horsetail (top growth), chickweed, lamb's-quarters, ball mustard, wild mustard, wormseed mustard, tumble mustard, Canada thistle (top growth) and other MCPA susceptible weeds. UPTAKE AND TRANSLOCATION: Readily absorbed by leaves of susceptible plants and translocated to the growing points. BASIS OF SELECTIVITY: The low rate of cyanazine is generally non toxic to the crop. Grasses are not affected by MCPA. APPLICATION METHODS: Postemergence when the crop is in the 2 to 5 leaf stage, and weeds are small (have less than 5 leaves) and actively growing. RESIDUAL ACTIVITY: A few days to a week, depending on soil moisture. UNIQUE CHARACTERISTICS: May cause temporary yellowing of lower leaves if crop is under stress due to lack of moisture or temperature extremes.

CYCLOATE. TRADE NAME: RO-NEET. CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Red beets, spinach. SENSITIVE WEEDS: Crab grasses, barnyard grass, foxtails, yellow nutsedge and some annual broadleaf weeds. UPTAKE AND TRANSLOCATION: Uptake by seed, roots and hypocotyl with upward translocation to the growing tip. BASIS OF SELECTIVITY: Species differentiation due to enzymatic detoxification and seed food reserves permitting seedling to outgrow effect of chemical. APPLICATION METHODS: Preplant incorporated. To prevent chemical loss, incorporate immediately into the soil by setting the incorporation equipment (i.e. tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be to a dry soil surface. RESIDUAL ACTIVITY: Season long weed control with no soil residues the following year to prevent crop rotation. UNIQUE CHARACTERISTICS: Does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavorable germination conditions, leaf crinkling or leaf sealing may be observed, but usually without adverse effects on crop yield.

DAZOMET. TRADE NAME: BASAMID. CHEMICAL FAMILY: Dithiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Field and greenhouse vegetable seedbeds for eggplant, lettuce, pepper and tomato; fall treatment only of tobacco greenhouse seedbeds; field and greenhouse seed and planting beds for annual flowers; turf seedbeds. SENSITIVE WEEDS: Most germinating weed seeds. UPTAKE AND TRANSLOCATION: Breaks down on contact with soil moisture and releases toxic gases which control germinating weed seeds. BASIS OF SELECTIVITY: Non selective. Chemical must be completely dissipated from the seedbed before planting or injury may occur. Breaks down on contact with soil moisture and releases toxic gases which control germinating weed seeds. APPLICATION METHODS: Apply granular product to a well worked seedbed and incorporate evenly. Seal soil immediately after incorporation by rolling and flooding or by covering with heavy polyethylene plastic and sealing edges. After a waiting period of 10 to 40 days, depending on soil temperature, aerate the soil. Conduct a safety germination test before using treated soil. Do not use when soil temperature is below 6°C. RESIDUAL ACTIVITY: Depends on the rate applied, soil moisture and soil temperature. The gases are toxic to all growing plants and a safety germination test must be carried out to determine that the soil is safe for planting. UNIQUE CHARACTERISTICS: All controls unencysted nematodes and soil fungi.

DEFOAMERS. (See HALT, SPRAY ADJUVANT DEFOAMER)

DICAMBA. TRADE NAMES: BANVEL 480, DYCLEER. CHEMICAL FAMILY: Benzoic acid. CROP AND/OR NON-CROP REGISTRATIONS: Field corn, spring and winter wheat, spring barley, spring rye, oats, summer fallow and stubble, pastures, red fescue, low bush blueberries and turf; non crop areas such as roadsides, utility rights-of-way and railways. SENSITIVE WEEDS: Annual, perennial and biennial broadleaf weeds and numerous brush species including conifers. Particularly effective against velvetleaf, Canada thistle, field bindweed and various triazine-resistant broadleaf weeds. Control is best when weeds are small and actively growing. UPTAKE AND TRANSLOCATION: Readily absorbed by roots, stems or leaves and then translocated to other plant parts. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Preemergence or postemergence in field corn. For all other crops and non crop uses, postemergence applications are recommended. RESIDUAL ACTIVITY: Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at rates recommended for crop situations. UNIQUE CHARACTERISTICS: Dicamba is often mixed with grass herbicides or with phenoxy herbicides to provide a broader spectrum of weed control. Spray drift is toxic to sensitive plants in the same manner as 2,4-D; thus similar precautions should be followed. Cold weather conditions and/or subsequent high rainfall after dicamba application may lead to temporary corn injury particularly on early season hybrids in Eastern Ontario. There is also a possibility of dicamba vapor drift from treated plant foliage during high temperatures (in excess of 25°C). At higher rates, dicamba can be toxic to trees and shrubs having roots under the treated areas. See sections on Herbicide Drift and Reduction of Herbicide Drift.

DICAMBA/ 2,4-D. TRADE NAME: DYCLEER 24. CHEMICAL FAMILY: Benzoic acid/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Established turf and non crop land. SENSITIVE WEEDS: Deciduous and coniferous brush; broadleaf herbaceous weeds. APPLICATION METHODS: Postemergence. UNIQUE CHARACTERISTICS: More effective than 2,4-D alone for control of Canada thistle, bindweed, smartweed and conifers. Has greater soil activity than 2,4-D alone. Also notes on dicamba and 2,4-D.

DICAMBA/ ATRAZINE. TRADE NAME: MARKSMAN. CHEMICAL FAMILY: Benzoic acid/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Field corn. SENSITIVE WEEDS: Annual and biennial broadleaf weeds including the triazine-resistant biotypes. APPLICATION METHODS: Postemergence until the standing height of the corn is 13 cm (5 leaf stage). UNIQUE CHARACTERISTICS: This mixture provides excellent control of triazine-resistant broadleaf weeds, maintains a low level of triazine for short term residue, and gives improved control of velvetleaf. Also see notes on dicamba and atrazine.

DICAMBA/ MCPA. TRADE NAME: DYVEL CHEMICAL FAMILY: Benzoic acid/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Barley, spring wheat, winter wheat and oats. UNIQUE CHARACTERISTICS: Provides better control of mustards and hemp-

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

nettle than dicamba alone. Also see notes on dicamba and MCPA.

DICAMBA/ MCPA/ MECOPROP. TRADE NAME: TARGET CHEMICAL FAMILY: Benzoic acid/phenoxy/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Spring wheat, barley, oats not underseeded to legumes, stubble fields and summer fallow. SENSITIVE WEEDS: At field crop rates - wild buckwheat, cow cockle, lady's-thumb, green smartweed, mustards, hemp-nettle, Russian thistle, corn spurry, flixweed, annual sow-thistle, shepherd's-purse, common ragweed, pigweeds, chickweed, lamb's-quarters, knotweed, volunteer rapeseed and sunflowers. APPLICATION METHODS: Postemergence when weed seedlings are in the 2 to 3 leaf stage, spring wheat and oats are in the 4 to 5 leaf stage, and barley is in the 2 to 3 leaf stage. Use water carrier and apply at 100 litres total spray mix per hectare. UNIQUE CHARACTERISTICS: This mixture controls a wider spectrum of weeds than any of the herbicide components used alone. Under certain conditions, this mixture may cause shortening of the straw of cereals but yield will not be affected.

DICHLOBENIL. TRADE NAME: CASORON CHEMICAL FAMILY: Benzonitrile. CROP AND/OR NON-CROP REGISTRATIONS: Cranberries, fruit trees, grapes, high bush blueberries, raspberries, woody nursery stock, shelterbelts and non crop areas. SENSITIVE WEEDS: Most weeds are susceptible to, or suppressed by, dichlobenil including perennials, vetch and horsetail. UPTAKE AND TRANSLOCATION: Absorbed by the roots and rapidly translocated upward in the plant. BASIS OF SELECTIVITY: Selectivity is based on physical separation between the dichlobenil vapor layer in the top 5 cm of soil and the established crop roots below this level. APPLICATION METHODS: Applied preemergence to the weeds, preferably in either fall or early spring. RESIDUAL ACTIVITY: May persist and provide weed control for 2-6 months; higher rates and applications following use in previous year(s) may result in soil residues persisting for longer than one year. UNIQUE CHARACTERISTICS: Although applied as a granular herbicide it kills by means of a vapor phase in the top soil profile. Weed roots take up the herbicide as they enter this zone. Do not apply dichlobenil during periods of high soil temperature, since loss of control will result due to volatilization of the herbicide.

DICHLORPROP/ 2,4-D. TRADE NAMES: DIPHENOPROP (700 G/L), DIPHENOPROP (600 G/L), DIPHENOPROP, SEE ESTAPROP, WEEDONE CB, SILVAPROP. CHEMICAL FAMILY: Phenoxy/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Spring and fall wheat and barley; turf; perennial weed and brush control on non crop land. UNIQUE CHARACTERISTICS: Most properties of dichlorprop are very similar to those of 2,4-D. Chickweed, wild buckwheat, smartweed and some woody species are more sensitive to dichlorprop/2,4-D than to 2,4-D alone. Do not use on oats.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

DICLOFOP-METHYL. TRADE NAME: HOE-GRASS 284 CHEMICAL FAMILY: Phenoxy/phenoxy,. CROP AND/OR NON-CROP REGISTRATIONS: Potatoes, white beans, kidney beans, carrots, onions, snap beans, soybeans, rapeseed (canola), lima beans, wheat barley, mustard, alfalfa, clover, peas. SENSITIVE WEEDS: Barnyard grass, foxtails, witch grass, fall panicum, wild oats, volunteer corn. UPTAKE AND TRANSLOCATION: Primarily through the leaves. Does not translocate significantly. BASIS OF SELECTIVITY: Differential metabolism by tolerant vs. sensitive species. APPLICATION METHODS: Postemergence when grass weeds are in the 1 to 4 leaf stage. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: Tank mixtures with broadleaf herbicides will result in reduced weed control. A time interval of 4 days before or after an application of diclofop-methyl is required.

DIFENZOQUAT. TRADE NAME: AVENGE 200C CHEMICAL FAMILY: Quaternary ammonium. CROP AND/OR NON-CROP REGISTRATIONS: Barley, spring wheat (Neepawa, Glenlea, Selkirk, Chester, Macoun, Canuck, Benito, Columbus, Fielder and Leader cultivars only); triticale (Welsh and Carmen); winter wheat (Norstar and Sundance); fall rye (Cougar, Puma, Frontier, Rymin and Kodiak); canary grass; forages underseeded to barley or wheat. SENSITIVE WEEDS: Wild oats (tame oats also killed). UPTAKE AND TRANSLOCATION: Readily absorbed by foliage. Not translocated. BASIS OF SELECTIVITY: Not established. APPLICATION METHODS: Postemergence to actively growing wild oats at the 3 to 5 leaf stage. Do not apply to plants that are wet with dew or rain, or if rain is expected within 6 hours. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: The lower leaves of barley can be injured if cool weather conditions are present at the time of spraying or up to 2 days after. Frost or temperatures within 2 degrees of frost will accentuate this injury. This injury is usually temporary and does not reduce barley yield. See label for registered tank mixes.

DIQUAT. TRADE NAME: REGLONE CHEMICAL FAMILY: Bipyridylium. CROP AND/OR NON-CROP REGISTRATIONS: Desiccation of canola (rapeseed), flax, dry beans, dry peas, mustard, sunflowers, soybeans, adzuki beans, legume seed crops. Vine killing of potatoes. Control of corn spurry in oats. Stale seedbed and inter-row weeding. SENSITIVE WEEDS: Any foliage contacted by diquat will be killed. UPTAKE AND TRANSLOCATION: Rapidly absorbed by foliage. Limited translocation. BASIS OF SELECTIVITY: None. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Essentially none due to adsorption of chemical to soil particles. UNIQUE CHARACTERISTICS: Must be used with clean (non-turbid) water as the soil particles in muddy water drastically reduce the effectiveness of diquat. Apply in weather conditions that will not promote drift. Suggested conditions for good application are moderate temperatures (less than 25°C), humidity (greater than 40%), and wind (3.6-10 kph). Do not apply in dead calm conditions or when temperature inversion is likely (e.g. morning or evening when warm air is rising from crop). To avoid spray drift, use flat fan or hollow cone nozzles and a pressure of 140 to 210 kPa, with the nozzles pointed back 130° to 180°. For further information on aerial application refer to the product label.

DIQUAT(AQUATIC). TRADE NAME: REGLONE A REGLONE A CHEMICAL FAMILY: Bipyridylium. CROP AND/OR NON-CROP REGISTRATIONS: Aquatic weed control in still or flowing water in ponds, ditches, lakes and canals. SENSITIVE WEEDS: Coontail, Canada water weed, pondweeds, milfoil and duckweed. UPTAKE AND TRANSLOCATION: Contact desiccant with limited translocation. BASIS OF SELECTIVITY: None. APPLICATION METHODS: Postemergence. Apply when weeds are visible and are actively growing. It can be applied: with a boat bailer device which injects the chemical below the water surface; sprayed over the water surface; or poured directly from a container onto the surface. RESIDUAL ACTIVITY: Quickly inactivated by adsorption to soil particles. UNIQUE CHARACTERISTICS: Must be used with and applied on non-turbid water, as the soil particles in muddy water drastically reduce the effectiveness of the material. Apply at dusk. Do not use treated water for swimming or consumption by humans or animals for at least 24 hours. Do not use water for irrigation for 5 days after treatment. To avoid fish kills caused by oxygen depletion, treat only 1/4 to 1/3 of the area at a time. Avoid application or drift onto crops, lawns, grazing areas, ornamental plants and other desirable plants.

DIURON. TRADE NAME: KARMEX CHEMICAL FAMILY: Substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Grapes, asparagus, gladioli, industrial sites, right-of-ways. SENSITIVE WEEDS: Annual and perennial grasses, pigweed, ragweed, wild carrot and dandelion. Perennial weed control at higher rates in non crop areas. UPTAKE AND TRANSLOCATION: Most readily absorbed by roots, less so by foliage. Translocated upward in the xylem. BASIS OF SELECTIVITY: Used only in deep rooted crops that are well established. APPLICATION METHODS: Applied to crops as a preemergence or directed early postemergence spray, preferably before weed growth becomes dense. Better control of emerged weeds is obtained by the addition of a suitable surfactant. In non crop areas, diuron may be sprayed anytime except when ground is frozen. RESIDUAL ACTIVITY: At lower rates used in crops, residues last about a year, and thus applications may be repeated annually. At higher non crop rates, persistence may be more than one year. UNIQUE CHARACTERISTICS: Should not be used where it is likely to leach or wash into contact with the roots of desirable trees or shrubs.

DRIFT CONTROL AGENTS. (See BIVERT-PH, LO-DRIFT, NALCO-TROL)

ENHANCE. TYPE OF ADJUVANT: Cationic surfactant with an additional non-ionic component. CHEMICAL COMPOSITION: Mixture of tallow fatty acid amine ethoxylate and nonylphenoxy polyethoxy ethanol. REGISTERED USES: Season long control of quack grass at low rate of glyphosate. BENEFIT: Improves consistency of performance, particularly at high water volumes and under stressful growing conditions. MODE OF ACTION: Improves leaf wetting and adhesion; increases overall penetration, resulting in enhanced uptake of glyphosate. MIXING: After half filling the sprayer tank with clean water, add the required amount of glyphosate. While agitating, add the required amount of ENHANCE (.5 L/ha in 100-200 L/ha of water) and complete filling the sprayer tank with water.

EPTC. TRADE NAME: EPTAM CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Alfalfa, bird's-foot trefoil, snap or dry beans (including kidney), flax, potatoes, sunflowers, woody nursery stock and annual flowers. SENSITIVE WEEDS: Annual grasses such as crab grass, barnyard grass, fall panicum, wild oats, green foxtail and yellow foxtail; yellow nutsedge; some annual broadleaf weeds such as corn spurry, lamb's-quarters, nightshade, pigweed and chickweed if conditions are favorable for germination and growth. UPTAKE AND TRANSLOCATION: Uptake by underground plant parts (roots, hypocotyl and seed). Upward translocation to the growing tip. BASIS OF SELECTIVITY: Metabolized by tolerant species at the seed germination stage through enzymatic breakdown of the chemical. Seed food reserves also permit seedling to outgrow chemical effect. APPLICATION METHODS: Preplant incorporated or postplant incorporated. May be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, EPTC should be uniformly incorporated in the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be a dry soil surface. RESIDUAL ACTIVITY: Applied in the spring preplant, EPTC provides season long weed control with no soil residues the following year to prevent crop rotation. UNIQUE CHARACTERISTICS: EPTC does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavorable germination conditions, leaf crinkling or leaf sealing may be observed on certain crops but usually without adverse effects on yield. May be tank mixed with metribuzin for additional broadleaf weed control in potatoes. See label for other tank mix combinations and information on less conventional methods of application.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

EPTC/ R25788 (EPTC$^+$). TRADE NAME: ERADICANE CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field and sweet). SENSITIVE WEEDS: Annual grasses such as wild oats, crab grass, barnyard grass, foxtails, fall panicum; suppression of wild proso millet; yellow nutsedge, horsetail and some annual broadleaf weeds when conditions are favorable for germination and growth. UPTAKE AND TRANSLOCATION: Uptake by underground plant parts (roots, hypocotyl and seed) then upward translocation to the growing tip. BASIS OF SELECTIVITY: Metabolized by tolerant species at the seed germination stage through breakdown of the chemical. R25788 enhances the enzymatic breakdown of the chemical in tolerant species. Also, seed food reserves permit corn seedlings to outgrow chemical effect. APPLICATION METHODS: EPTC/R25788 may be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, EPTC/R25788 should be uniformly incorporated into the soil by setting the incorporation equipment (i.e. tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be to a dry soil surface and incorporation should be made within 4 hours of application. Preplant incorporated EPTC+ may be used in tank mix combination with atrazine for additional broadleaf weed control. RESIDUAL ACTIVITY: Provides season long weed control with no soil residues the following year to prevent crop rotation. In tank mix combinations with atrazine, there may be atrazine residues when the highest atrazine rate is used. UNIQUE CHARACTERISTICS: EPTC/R25788 does not need rainfall to be activated and will not leach significantly under heavy rainfall.

ETHALFLURALIN. TRADE NAME: EDGE CHEMICAL FAMILY: Dinitroanaline. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans, dry beans (white or kidney) and canola (rapeseed). SENSITIVE WEEDS: Provides excellent control of annual grasses and good control of pigweed and lamb's-quarters, including the triazine-resistant strains of these weeds. Will also provide suppression of nightshade and lady's-thumb. UPTAKE AND TRANSLOCATION: No significant absorption or translocation of ethalfluralin in crops grown in soil treated with ethalfluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled. BASIS OF SELECTIVITY: Physiological growth processes associated with seed germination. APPLICATION METHODS: Preplant incorporated. Apply in 100-300 L of water per hectare. Use lower rates of the chemical on sandy soils and increasing rate for loam to clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Vigorous, continuous agitation is essential for proper mixing. All in line screens should be 50 mesh or coarser. Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or tine cultivator (10-13 km/hr) set to work 8 to 10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed up to 24 hours. The second incorporation is recommended anytime before planting. Activated upon incorporatrion; rainfall is not required. RESIDUAL ACTIVITY: Recommended application rates provide season long weed control. Succeeding crops, even fall seeded grain crops planted in soil that received ethalfluralin the preceding spring, will not be injured under normal conditions. UNIQUE CHARACTERISTICS: Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

FENOXAPROP-ETHYL. TRADE NAME: EXCEL CHEMICAL FAMILY: Phenoxy/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Asparagus, broccoli, cabbage, cauliflower, carrots, dry common beans (kidney, pinto and white only), onions (dry bulb only), peas (field and processing), potatoes, canola (rapeseed), triazine-tolerant canola, soybeans, tomatoes. SENSITIVE WEEDS: Barnyard grass, green and yellow foxtail, crab grass, witch grass, wild proso millet, fall panicum, volunteer corn. UPTAKE AND TRANSLOCATION: Uptake primarily through the leaves. Does not translocate significantly. BASIS OF SELECTIVITY: Differential metabolism by tolerant vs. sensitive species. APPLICATION METHODS: Non residual postemergence for the control of annual grasses in the 1 to 6 leaf stage. For best results, apply when weeds are young and actively growing. Do not apply if rainfall is expected within one hour of application. UNIQUE CHARACTERISTICS: EXCEL can be tank mixed with BASAGRAN for broad spectrum annual weed control in soybeans and dry beans only. If annual grasses are in the correct stage for application before broadleaf weeds have emerged, do not delay EXCEL application.

FLAMPROP-METHYL. TRADE NAME: MATAVAN CHEMICAL FAMILY: Acetanilide. CROP AND/OR NON-CROP REGISTRATIONS: Wheat, triticale, canary grass, sunflowers and certain forage crops. SENSITIVE WEEDS: Wild oats. UPTAKE AND TRANSLOCATION: Absorbed through the leaves. Translocated in the phloem to the stem. BASIS OF SELECTIVITY: Tolerant species metabolize the herbicide faster than wild oats. APPLICATION METHODS: Postemergence. Apply when wild oats are in the 3 to 6 leaf stage. RESIDUAL ACTIVITY: Although the half-life in soil is from 1 to 3 weeks there is very little soil activity. UNIQUE CHARACTERISTICS: Rainfall within 2 hours of application will reduce effectiveness. Common oats are also killed by this herbicide.

FLUAZIFOP-BUTYL. TRADE NAME: FUSILADE CHEMICAL FAMILY: Pyridoxyphenoxypropionate. CROP AND/OR NON-CROP REGISTRATIONS: Flax, canola, soybeans, sugar beets, sunflowers, tobacco, forage legumes (alfalfa, red clover and bird's-foot trefoil), onions, potatoes, tomatoes, strawberries; non grassy ornamental plants, shrubs, trees; non bearing apples and pears; forest and ornamental nurseries. SENSITIVE WEEDS: Annual grass species, volunteer corn, wheat, barley and quack grass. UPTAKE AND TRANSLOCATION: Absorbed primarily by leaves. Translocated to roots and rhizomes. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Postemergence. Apply when grasses are actively growing, and annual grasses are in the 2-5 leaf stage and quackgrass is in the 3 to 5 leaf stage. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: Preplant tillage to break up rhizomes will improve control of quack grass. Except as noted on the label, broadleaf herbicides should be applied separately at least 3 days after fluazifop-butyl. Do not cultivate for 5 days after applying fluazifop-butyl. When plants are stressed (lack of moisture, excessive humidity, low temperature and/or very low relative humidity), fluazifop-butyl is less effective. Regrowth by tillering may occur if application is made under any of the above conditions. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

FOSAMINE AMMONIUM. TRADE NAME: KRENITE CHEMICAL FAMILY: Carbamoyl phosphonate. CROP AND/OR NON-CROP REGISTRATIONS: Vine and brush control on non crop land. SENSITIVE WEEDS: Control and growth suppression of blackberry, oak, pine, sumac, maple, elder, elm, wild rose, hazel, aspen and beech. Cedar and spruce are quite tolerant. UPTAKE AND TRANSLOCATION: Absorption by young stems and foliage. Translocation has been observed from a treated mature leaf to all other parts of a plant but phloem transport with sugars is predominant. BASIS OF SELECTIVITY: Not highly selective. APPLICATION METHODS: Postemergence. Apply in high pressure ground equipment to ensure penetration of spray to thoroughly wet leaves, buds, stems and trunks of target brush. Surfactants are recommended to promote rapid leaf penetration. RESIDUAL ACTIVITY: Essentially none. UNIQUE CHARACTERISTICS: Woody plants treated with fosamine ammonium die very slowly; the stems may not be completely killed 2 years after treatment; the unsightly brown-out effect common to may other herbicides does not occur. Rainfall within 24 hours of application may decrease effectiveness.

FRIGATE. TYPE OF ADJUVANT: Cationic surfactant. CHEMICAL COMPOSITION: Mixture of ethoxylated long-chain fatty amines. REGISTERED USES: Season long control of quack grass at the lower rate of glyphosate (0.84 kg/ha) when applied with a water volume of 150-300 L/ha. BENEFIT: More consistent season long control of quack grass at low rate of glyphosate. MODE OF ACTION: Improves wetting of foliage and enhances uptake of glyphosate. MIXING: Add glyphosate to the required amount of water in the spray tank under agitation; than add FRIGATE at 0.5 litres per 100 litres of spray mix. When water temperature is less than 5°C premix FRIGATE with an equal volume of warm water before adding to spray tank.

FUMIGANTS. (See METAM SODIUM, METHYL-BROMIDE/CHLOROPICRIN, METHYL ISOTHIOCYANATE/DICHLOROPROPENE, METHYL ISOTHIOCYANATE/DICHLOROPROPENE/CHLOROPICRIN)

GLYPHOSATE. TRADE NAME: CLEAR-IT 1, CLEAR-IT 2, CLEAR-IT 3, EXPEDITE GRASS & WEED, EZJECT, LAREDO, ROUNDUP, VISION, WRANGLER. CHEMICAL FAMILY: N-(phosphonomethyl) glycine. CROP AND/OR NON-CROP REGISTRATIONS: LAREDO, ROUNDUP, WRANGLER - preplant or post-harvest with no cropping restrictions; directed applications in cherries, grapes, apples, pears, plums and peaches. Non-crop registrations: EXPEDITE GRASS & WEED, ROUNDUP - brush control; turf renovation; chemical mowing; directed application in woody nursery stock, roadsides and shelterbelts. EZJECT - selective woody brush and tree control. VISION - silvicultural site preparation, conifer release, forest tree plantings, forest tree nurseries. SENSITIVE WEEDS: Annual grasses; perennial weeds (quack grass, Canada thistle, field bindweed, milkweed, cattails, nutsedge, poison-ivy and strawberry); brush (birch, alder, poplar, raspberry, willow and maple. UPTAKE AND TRANSLOCATION: Absorbed through foliage and translocated throughout the plant. BASIS OF SELECTIVITY: Non selective for agricultural crops. Conifers are tolerant but the basis has not been established. APPLICATION METHODS: Postemergence, usually at the prebloom stage of growth for most perennial weeds. Canada thistle should be at least in early flower bud, milkweed at flower bud, and bindweed at full flower. Quack grass can be treated in the spring or fall when it is actively growing with at least 3 to 4 new leaves on each emerged shoot; in the fall, remove crop refuse but do not till prior to application; fall or spring tillage prior to spring application may reduce control; wait at least 5 days after application before working the area; for maximum control it is advisable to till before the quack grass turns completely brown. Glyphosate can be applied with boom equipment, knapsack sprayers and high-volume equipment for agricultural and non crop uses. Backpack mist blowers may be used for silvicultural site preparation and roadside brush control only. Aerial applications may be used for silvicultural site preparation and conifer release only. Can also be applied with selective equipment for non crop areas, tree plantings, grapes and orchards (See sections entitled "Special Methods of Weed Control" and "Selective Weed Control with Wiper Applicators"). Regardless of method of application, do not allow herbicide solution to contact green foliage or green bark of crop or other desirable plants; remove all suckers from the trunks of desirable trees before spraying. RESIDUAL ACTIVITY: None: crops can be planted or

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

seeded directly into treated areas following application. Other herbicides are required to control weeds emerging after the application. UNIQUE CHARACTERISTICS: Rainfall within 6 hours after application or heavy frost may reduce control.

HALT. TYPE OF ADJUVANT: Defoamer. CHEMICAL COMPOSITION: Silicone base, neutral. REGISTERED USES: To reduce foaming when preparing herbicide spray mixes. BENEFIT: The reduction of foaming allows faster tank fill ups, ensures correct fill volumes, reduces the possibility of chemical overflow and gives more accurate herbicide application. MIXING: Add 7 mL per 500 L of spray mix. May be added to spray tank during filling to prevent foaming, or after to cut foam. UNIQUE CHARACTERISTICS: May be used with any herbicide unless indicated on the label.

HERBICIDAL OIL. (See MINERAL OIL [HERBICIDAL])

HEXAZINONE. TRADE NAMES: PRONONE, VELPAR CHEMICAL FAMILY: Triazine. CROP AND/OR NON-CROP REGISTRATIONS: Christmas trees, coniferous reforestation, non crop land. SENSITIVE WEEDS: Most herbaceous broadleaf weeds and grasses including raspberry, bluejoint grass, goldenrod and brome grass; spot applications control aspen, ash, maple, cherry and birch. UPTAKE AND TRANSLOCATION: Absorbed through roots and foliage; translocation is primarily upwards through xylem. BASIS OF SELECTIVITY: Tolerant species metabolize hexazinone faster than sensitive species. For conifers, at least part of the selectivity is due to the tree roots being deeper than hexazinone leaches into the soil. APPLICATION METHODS: For broadcast applications, apply preemergence or as a postemergence foliar spray during active plant growth. For spot applications, use an exact delivery hand gun applicator to apply undiluted VELPAR-L as close as possible to the root collar of plants to be controlled; keep spots at least one metre away from desirable conifers. Apply PRONONE with an approved granular applicator. RESIDUAL ACTIVITY: Half-life of 2 months on a Flanagan silt loam in Illinois. Half-life of 2 1/2 months on a silty clay in northern Ontario. UNIQUE CHARACTERISTICS: Rainfall is needed to activate hexazinone in the soil. Do not use on sandy, gravelly or rocky soils, or on frozen ground. Do not apply on steep slopes. Do not apply to areas where the roots of desirable trees may extend. Liquid formulation is flammable. A bioassay may be used to determine soil residue levels when sensitive crops are to be planted in soil treated with hexazinone.

IMAZETHAPYR. TRADE NAME: PURSUIT CHEMICAL FAMILY: Imidazolinone. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans. SENSITIVE WEEDS: Soil applications - green foxtail, yellow foxtail, old witch grass, barnyard grass, lamb's-quarters, redroot pigweed, smartweed, lady's-thumb, wild mustard, velvetleaf, common ragweed and reduced competition from eastern black nightshade and proso millet. Posemergence application - green foxtail, yellow foxtail, witch grass, barnyard grass, redroot pigweed, velvetleaf, wild mustard, cocklebur, eastern black nightshade, ragweed and reduced competition from proso millet, large crabgrass, lamb's-quarters and wild buckwheat UPTAKE AND TRANSLOCATION: Absorbed by both roots and foliage. Translocation in both xylem and phloem. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Early preplant (up to 30 days before planting), preemergence and post emergence up to the 2 leaf stage of weeds. RESIDUAL ACTIVITY: Persistence depends on weather and soil conditions (more persistent under dry conditions). Rotational cropping restricted to soybeans, corn, spring barley, spring wheat, and winter wheat. UNIQUE CHARACTERISTICS: Can be applied up to 30 days prior to planting. Registered for use in reduced and no-till situations. Tank mixing is recommended for heavy infestations of ragweed or barnyard grass. Postemergence application requires the addition of a non-ionic surfactant and liquid fertilizer solution. Temporary soybean discoloration and/or shortening may occur with postemergence applications. A period of 120 days is required between application and planting winter wheat.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

KORNOIL. TYPE OF ADJUVANT: Mineral oil (non-herbicidal). CHEMICAL COMPOSITION: 98.5% mineral oil, 1.5% emulsifier. REGISTERED USES: (Crop/herbicide): Corn/atrazine. BENEFIT: Improved postemergence activity of atrazine, especially on quack grass, yellow nutsedge and annual grasses. MODE OF ACTION: Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily. MIXING: Fill spray tank with water allowing space for subsequent addition of atrazine and oil; engage agitation and pour in premixed slurry of atrazine in water; add KORNOIL last. Avoid excessive agitation of the spray mix as this may cause coagulation or buttering out. UNIQUE CHARACTERISTICS: To prevent a buildup of oil in the sprayer, empty the tank as completely as possible before refilling. Some injury may occur if the crop is stressed (cold, backward weather or hot, dry weather).

KORNOIL CONCENTRATE. TYPE OF ADJUVANT: Mineral oil/surfactant (non-herbicidal). CHEMICAL COMPOSITION: Paraffin base mineral oil 85%, surfactant blend 15%. REGISTERED USES: To be blended with atrazine/water mixtures and applied postemergence in corn. BENEFIT: Improved postemergence activity of atrazine, especially on quack grass, yellow nutsedge and annual grasses. MODE OF ACTION: Partially dissolves waxy cuticle of weeds allowing atrazine to penetrate more readily. Also reduces evaporation and aids in spreading of spray droplets on the leaf surface leading to a longer period for penetration. MIXING: Avoid violent agitation; partially fill sprayer, add atrazine slurry, add KORNOIL CONCENTRATE last. UNIQUE CHARACTERISTICS: Some injury may occur with cold, rainy, backward weather.

LINURON. TRADE NAME: AFOLAN F, LOROX DF, LOROX DF TOSS'N GO, LOROX L. CHEMICAL FAMILY: Substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Corn, soybeans, carrots, celery, dill, parsnips, potatoes, asparagus, wheat, oats, barley, gladioli, fruit trees. SENSITIVE WEEDS: Annual weeds such as barnyard grass, common chickweed, corn spurry, crab grass, velvetleaf, fall panicum, foxtail, goosefoot, goose grass, groundsel, knotweed, lamb's-quarters, redroot pigweed, purslane, common ragweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, witch grass, wormseed mustard, triazine resistant weeds; seedlings only of dandelion, plantain and sow-thistle. UPTAKE AND TRANSLOCATION: Readily absorbed through roots, less so through foliage; translocation primarily upwards in xylem. BASIS OF SELECTIVITY: Differencial metabolism often coupled with differential uptake and translocation. APPLICATION METHODS: Preemergence, postemergence, directed postemergence, pre plus postemergence. RESIDUAL ACTIVITY: Does not pose a problem for subsequent crops since phytotoxic residues from applications at agricultural rates disappear within 4 months. UNIQUE CHARACTERISTICS: Do not use on sandy or coarse textured soils having less than 2% organic matter. If unusually heavy rains follow application, severe injury may occur to corn, soybeans, carrots and potatoes.

LO-DRIFT. TYPE OF ADJUVANT: Drift control agent. CHEMICAL COMPOSITION: Non-ionic polyacrylamide. REGISTERED USES: In combination with most water soluble, emulsifiable concentrate or wettable powder herbicides. For non crop and industrial uses. BENEFIT: Drift control. MODE OF ACTION: Reduces spray breakup and thus the number of fine driftable droplets. MIXING: Always add LO-DRIFT to water, never add water to LO-DRIFT. Add the herbicide to the water first and agitate. Ensure full dispersion of the herbicide before adding LO-DRIFT. Add LO-DRIFT slowly in a pencil thin stream to the spray solution while under vigorous agitation. UNIQUE CHARACTERISTICS: Can be slippery if spilled. Absorb by sprinkling with absorbent material.

MALEIC HYDRAZIDE. TRADE NAME: ROYAL MH 60 SG CHEMICAL FAMILY: Unique. CROP AND/OR NON-CROP REGISTRATIONS: Growth control in lawns, turf, trees and shrubs. Sprout control in stored onions and potatoes. SENSITIVE WEEDS: Controls the growth of wild onion, garlic and biennial type weeds such as dandelion and plantain when applied in the fall. UPTAKE AND TRANSLOCATION: Absorbed through foliage. Translocated to active growing points in plant. Translocated more effectively downwards. BASIS OF SELECTIVITY: Not established. APPLICATION METHODS: Postemergence. Use as a foliar spray. Dosage and stage of plant development are critical factors. To reduce or eliminate mowing, apply in the spring or fall to green non-dormant grass; can be mixed with 2,4-D for spring applications. For tree and shrub growth control, apply to the portion of the plant on which growth is to be inhibited; growth control is best when applied to vigorous new growth; spray leaves and bark to point of runoff. RESIDUAL ACTIVITY: None. UNIQUE CHARACTERISTICS: Do not apply on or near crops being grown for seed. Rain within 24 hours after application will reduce effectiveness. Since temporary discoloration of grass may result, this chemical is recommended for use in areas where mowing grass is difficult and where lawn like appearance is not necessary.

MCPA. TRADE NAME: ESTEMINE, MCPA, METHOXONE, MCPA-SODIUM SALT, MCPA AMINE, METHOXONE SODIUM. CHEMICAL FAMILY: Phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Cereal crops, turf, non crop sites. SENSITIVE WEEDS: Many broadleaf weeds, especially buttercup, hempnettle, field horsetail (top growth only), seedling dock. UPTAKE AND TRANSLOCATION: Absorbed through leaves or roots. Translocates to, and accumulates at, growing points of shoots and roots. BASIS OF SELECTIVITY: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites leads to greater activity in broadleaf weeds than grasses APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Some soil residues can be detected for up to one month under moist conditions and 2 months under drier conditions. UNIQUE CHARACTERISTICS: MCPA is available in 3 different formulations (potassium or sodium salt, amine and ester). It is safter than 2,4-D for use on oats, flax and peas. As the 2,4-D, there is a potential drift hazard to nearby susceptible crops such as grapes, turnips, tobacco and cabage.

MCPB/MCPA. TRADE NAME: TROPOTOX PLUS CHEMICAL FAMILY: Phenoxy/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Seedling white, ladino, alsike or red clovers direct seeded or underseeded in wheat, oats, barley, rye, pastures, field corn, peas, apples. SENSITIVE WEEDS: Small emerged mustards, stinkweed, ragweed, lamb's-quarters, redroot pigweed, shepherd's-purse, volunteer rapeseed, wild radish, hempnettle, annual sow-thistle; top growth control of bull thistle, Canada thistle, curled dock, plantain, perennial sow-thistle, field bindweed, horsetail, buttercup. UPTAKE AND TRANSLOCATION: Absorbed through the foliage and readily translocated, especially to the growing points. BASIS OF SELECTIVITY: MCPB is not directly toxic to plants. Susceptible weeds convert MCPB to MCPA. APPLICATION METHODS: Postemergence. In cereals, clovers and peas, apply as an overall spray. In corn apply with drop pipes after the corn reaches 45 cm before the beginning of tasselling. Apply to pastures after grazing or cutting

MECOPROP. TRADE NAMES: COMPITOX, COMPITOX PLUS, MCPP, MECO-D, MECOPROP, MECOPROP PLUS 2,4-D, MECOTURF PLUS 2,4-D. CHEMICAL FAMILY: Phenoxy. CROP AND/OR NON-

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

CROP REGISTRATIONS: Turf. SENSITIVE WEEDS: Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion. For complete control of Canada thistle, dandelion and black medick, a repeat application will likely be required. UPTAKE AND TRANSLOCATION: Absorbed readily by foliage and translocated to roots and throughout shoots, especially to growing points. BASIS OF SELECTIVITY: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses. APPLICATION METHODS: Postemergence. Apply to cereals between the 3 leaf and early flag leaf stage. In lawns and turf apply when weeds are actively growing (May, June and September). RESIDUAL ACTIVITY: Can persist in soil up to 4 weeks, however, grass can normally be seeded within 1 to 2 weeks after treatment. UNIQUE CHARACTERISTICS: Controls 2,4-D resistant weeds such as chickweed, clovers, black medick and young knotweed. Do not spray on grain underseeded to legumes. If cereals are stressed at the time of application deformed heads and missing florets may result. Can be safely used on bent grass, however, injury may occur if temperature is above 27°C. Effectiveness will be reduced if rain occurs within 4-6 hours after treatment.

MECOPROP/ 2,4-D. TRADE NAMES: COMPITOX PLUS, EXPEDITE BROADLEAF, MECO-D, MECOPROP PLUS 2,4-D, MECOTURF PLUS 2,4-D, PREMIUM LAWN WEED KILLER, TURF-RITE 2+2. CHEMICAL FAMILY: phenoxy/phenoxy. UPTAKE AND TRANSLOCATION: Absorbed through leaves and roots translocates to growing points. BASIS OF SELECTIVITY: Differences in interception, penetration, translocation, metabolism, and sensitivity of active sites result in broadleaf species being more sensitive than grasses. APPLICATION METHODS: Postemergence. Apply when weeds are actively growing. EXPEDITE BROADLEAF is a ready to use formulation which must be applied with Expedite application equipment.

MERGE. TYPE OF ADJUVANT: surfactant/solvent. CHEMICAL COMPOSITION: 50% surfactant blend plus 50% solvent (petroleum hydrocarbons). REGISTERED USES: For use with POAST (sethoxydim). BENEFIT: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions. MODE OF ACTION: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. Acts as a protectant against photodegradation of sethoxydim by UV light. MIXING: Fill spray tank half full with water, start agitation. Add required amount of herbicide and continue agitation. Add MERGE along with remaining water last to the tank. Agitate thoroughly after any stoppage in spraying. UNIQUE CHARACTERISTICS: May cause temporary topical burn to crop plants under hot, humid weather conditions.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

METAM SODIUM. TRADE NAME: VAPAM CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Field and greenhouse seedbeds. Field replant sites of fruits, vegetables, tobacco, ornamentals and forest tree stock. SENSITIVE WEEDS: Most scarified weed seeds and freshly vegetative parts including rhizomes and germinating seedlings. BASIS OF SELECTIVITY: Most plant parts are sensitive. Crops are not planted until all fumigant has dissipated from the soil. With moisture, methyl isothiocyanate gas is released which kills most scarified seeds and fleshy vegetative parts including rhizomes and germinating seedlings. APPLICATION METHODS: Apply uniformly using injectors, water or other incorporation tools to carry the product to the desired soil depth. May be applied via the irrigation system. No gas-proof cover is required unless the soil is very porous, however, a sprinkler application of water should be used to provide a surface "water seal". RESIDUAL ACTIVITY: 10 to 40 days depending on soil temperature and the amount of organic matter present in the soil. Persistence is greatest at low temperatures and high levels of organic matter. Planting may take place 12 to 16 days after the treatment and following a lettuce seedling bioassay that indicates no injury. UNIQUE CHARACTERISTICS: Also controls nematodes, soil fungi and soil insects. All traces of toxic gases must be dissipated from the treated soil before planting or plant injury may occur.

METHYL BROMIDE/ CHLOROPICRIN. CHEMICAL FAMILY: Organohalogen. TRADE NAMES: TERRAKLENE. CROP AND/OR NON-CROP REGISTRATIONS: Greenhouse and tobacco seedbeds. Methyl bromide is very poisonous to man and livestock; only an experienced operator should attempt its use. SENSITIVE WEEDS: Gas is toxic to germinating seedlings. APPLICATION METHODS: Formulated as a liquid under pressure which, when released from the container, form a gas. Soil must be sealed with a plastic sheet since the gas is highly volatile. Refer to label for detailed directions. UNIQUE CHARACTERISTICS: Methyl bromide gas is highly volatile, and highly poisonous to humans and livestock. It may be absorbed by inhalation, ingestion and dermal contact. A permit must be obtained from the Ontario Ministry of the Environment each time it is used. Also controls soil insects, nematodes and fungal diseases.

METHYL ISOTHYIOCYANATE/ DICHLOROPROPENE. TRADE NAME: VORLEX PLUS CHEMICAL FAMILY: Thiocarbmate. CROP AND/OR NON-CROP REGISTRATIONS: Preplant treatment in both field and greenhouse soils to be planted to: ornamental plants such as flowers and evergreens; vegetables such as celery, lettuce, beets, tomatoes, eggplant, beans, melons, onions, asparagus and squash; field crops such as tobacco, sugar beets, potatoes, ginseng; small fruits such as strawberries. SENSITIVE WEEDS: All growing weed seedlings within the fumigated zone. Non germinated seeds or established weeds may not be controlled. BASIS OF SELECTIVITY: Non selective. Gas is toxic to most young, green plant tissues. APPLICATION METHODS: Injected into the soil 15 to 20 cm deep using special application equipment. The soil surface is sealed by either surface irrigation or physically compacting the soil surface. Cultivation of the fumigated soil after the desired period of time allows the gas to escape. RESIDUAL ACTIVITY: Varies with soil type but usually 4 to 6 weeks if left undisturbed. Aways check the soil for fumigant using the lettuce germination test before planting a crop in it. UNIQUE CHARACTERISTICS: Also controls fungal diseases and unencysted nematodes.

METHYL ISOTHYIOCYANATE/ DICHLOROPROPENE/ CHLOROPICRIN. TRADE NAME: VORLEX PLUS CP UNIQUE CHARACTERISTICS: Chloropicrin provides added disease control to the mixture. See notes on previous chemical.

METOBROMURON. TRADE NAMES: PATORAN, PATORAN FL, PATORAN FL 1. CHEMICAL FAMILY: Substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans, dry common beans (kidney, white, yellow-eye), lima beans, snap common beans, adzuki beans, potatoes. SENSITIVE WEEDS: Annual broadleaf weeds (including triazine-tolerant biotypes) such as pigweed, lamb's-quarters, green smartweed, ragweed, lady's-thumb, shepherd's-purse, annual nightshades, cudweed, corn spurry, groundsel, purslane, chickweed, mustards and stinkweed. Some activity on annual grasses such as barnyard grass, crab grass, green foxtail, witch grass, annual blue grass and stink grass. The annual grasses are the first to escape treatment. UPTAKE AND TRANSLOCATION: Absorbed through the roots. Translocated in the transpiration stream to the leaves where it accumulates at the margins. BASIS OF SELECTIVITY: Achieved through differential interception of the herbicide. Metobromuron must be placed on the soil surface and move into the zone of germinating weed seeds but not come in contact with the roots of the germinating crop plants. APPLICATION METHODS: Preemergence. For beans, apply before the beans and weeds emerge; beans should be planted 4-5 cm deep; shallow planted crops may be injured; do not use on soils with less than 2% organic matter; optimum organic levels are 2-5%. For potatoes, metobromuron should be applied at ground crack after the first hilling, provided the soil completely covers the emerged potato tips. RESIDUAL ACTIVITY: Relatively short (6-8 weeks). UNIQUE CHARACTERISTICS: Moisture is required for distribution into the top layer of soil where weed seeds are germinating. Soil residues do not carryover to affect subsequent crop rotations.

METOLACHLOR. TRADE NAME: DUAL CHEMICAL FAMILY: Acetanilide. CROP AND/OR NON-CROP REGISTRATIONS: Corn, soybeans, snap beans (yellow and green only), dry beans (white, kidney and pinto only), lima beans, transplanted tomatoes, potatoes, sugar beets and rutabagas. Year of planting in apple, apricot, cherry, peach, pear and plum. SENSITIVE WEEDS: Large and smooth crab grass; witch grass; barnyard grass; fall panicum; giant, green and yellow foxtail; yellow nutsedge; American nightshade, eastern black nightshade. UPTAKE AND TRANSLOCATION: Absorbed by germinating grasses mainly through shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoots. BASIS OF SELECTIVITY: Not established. APPLICATION METHODS: Preplant incorporated and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6-10 km/hr or a vibrating shank cultivator at 10-13 km/hr; one incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application. RESIDUAL ACTIVITY: Activity will normally be maintained for 10-14 weeks. UNIQUE CHARACTERISTICS: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nutsedge control requires a preplant incorporated application. Winter cereals may be planted 4 to 5 months after metolachlor application. Many tank mix combinations are registered on various crops. Do not use on muck soils or coarse textured soils low in organic matter.

METOLACHLOR/ ATRAZINE. TRADE NAME: PRIMEXTRA CHEMICAL FAMILY: Acetanilide/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (ensilage, field, seed and sweet). SENSITIVE WEEDS: Germinating annual broadleaf weeds and annual grasses such as eastern black nightshade, lady's-thumb, lamb's-quarters, wild mustard, purslane, prostrate pigweed, redroot pigweed, wild buckwheat, smartweed, ragweed, crab grass, barnyard grass, green foxtail, yellow foxtail, giant foxtail, witch grass and fall panicum. Yellow nutsedge can be controlled with a preplant incorporated application. UPTAKE AND TRANSLOCATION: Mainly root uptake, with a small amount of shoot absorption. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Preplant incorporated, preplant, preemergence and early postemergence (spike to 2 leaf). One incorporation is sufficient and need not be immediate Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6-10 km/hr or a vibrating shank cultivator at 10-13 km/hr. Rainfall within 10 days is required for maximum activity of the preemergence application. Metolachlor/atrazine may be applied in liquid fertilizers for preplant incorporated or preemergence weed control. Dry bulk granular fertilizers may be impregnated with metolachlor/atrazine for preplant incorporation. RESIDUAL ACTIVITY: Activity will normally be maintained for 10-14 weeks; late germinating velvetleaf and fall panicum will not be controlled. Soybeans, white beans, oats, or barley may be planted the following spring. UNIQUE CHARACTERISTICS: Will not control triazine-resistant weed species.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

Contains atrazine in low amounts which may carryover in a dry year. Is effective over a wide range of soil types and has a good margin of crop safety. Perennial weeds are not controlled.

METRIBUZIN. TRADE NAMES: LEXONE DF TOSS'N GO, LEXONE DF, LEXONE L, SENCOR 500 F, SENCOR 75 DF, SENCOR, SOLUPAK. CHEMICAL FAMILY: As-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Established asparagus, faba beans, potatoes, soybeans, transplant tomatoes, apples, apricots, peaches, cherries, corn and triazine-tolerant canola (rapeseed). SENSITIVE WEEDS: Lamb's-quarters, wild mustard, redroot pigweed, common ragweed, shepherd's-purse, lady's-thumb, velvetleaf, jimsonweed, prostrate pigweed, Russian thistle, yellow wood-sorrel, prickly mallow, chickweed, cocklebur, carpetweed, dandelion seedlings, barnyard grass, crab grass, foxtail, fall panicum, witch grass, Johnson grass seedlings and cheat grass. UPTAKE AND TRANSLOCATION: Some uptake through the foliage but the major route is via the roots. Translocation upwards in the xylem. BASIS OF SELECTIVITY: Degradation by tolerant species. APPLICATION METHODS: Preplant incorporated (potatoes, soybeans, apples, apricots, peaches, cherries, corn, tomatoes and triazine-tolerant canola); preemergence (asparagus, potatoes, soybeans and triazine-tolerant canola); postemergence (potatoes, tomatoes, corn and triazine-tolerant canola). RESIDUAL ACTIVITY: Varies with the climate. At normal use rates the half-life is 1 to 2 months. UNIQUE CHARACTERISTICS: Heavy rainfall following application may cause crop damage. Some varieties of potato, soybean and tomato are less tolerant than other. Triazine-resistant weeds are not controlled. Do not use on muck soils.

MINERAL OIL. (NON-HERBICIDAL) (see KORNOIL)

MINERAL OIL (HERBICIDAL). TRADE NAME: AGRICULTURAL WEED KILLER NO. 1 CHEMICAL FAMILY: Aliphatic and aromatic hydrocarbons. CROP AND/OR NON-CROP REGISTRATIONS: Carrot, celery, dill, parsley, parsnips. SENSITIVE WEEDS: Annual weeds with the exception of ragweed, wormweed and wild carrot. UPTAKE AND TRANSLOCATION: Absorbed by foliage. Little or no translocation. BASIS OF SELECTIVITY: Low interception species such as the Umbelliferae family are tolerant. APPLICATION METHODS: Postemergence; broadcast or banded. For carrots, dill, parsley and parsnips, apply as soon as true leaves develop and before roots are thicker than a pencil. For celery apply as soon as true leaves develop. Weeds should be less than 10 cm tall. Best results will be obtained if spray is applied on cool sunny mornings; do not apply when excessively hot. RESIDUAL ACTIVITY: None. UNIQUE CHARACTERISTICS: Do not apply within 30 days of harvest as late application may flavor the harvested crop.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

MINERAL OIL/ SURFACTANT (NON-HERBICIDAL). (See ASSIST OIL CONCENTRATE, KORNOIL CONCENTRATE)

MONOLINURON. TRADE NAME: AFESIN CHEMICAL FAMILY: Substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans, white beans, yellow eye beans, kidney beans, lima beans, snapbeans, potatoes. SENSITIVE WEEDS: Particularly effective on most annual broadleaf weeds including the triazine-resistant species. Some activity on annual grasses but these will be the first to escape. Cultivation may be required. UPTAKE AND TRANSLOCATION: Primarily uptake is through the roots of germinating weed seedlings, although leaf uptake is possible. Translocated upwards in the xylem to the shoots. BASIS OF SELECTIVITY: Monolinuron is placed on the soil surface and moves down into the zone of germinating weed seeds but not deep enough to come in contact with the roots of germinating crop plants. APPLICATION METHODS: Preemergence. For beans apply before the beans and weeds emerge; beans should be planted 4 to 5 cm deep; shallow planted crops may be injured; do not use on soils with less than 3% organic matter. On potatoes, apply preemergence or when plants are covered by hilling. RESIDUAL ACTIVITY: Relatively short, 4-6 weeks. UNIQUE CHARACTERISTICS: Moisture is required for distribution into the top layer of soil where weed seeds are germinating.

NALCO-TROL. TYPE OF ADJUVANT: Drift control agent. CHEMICAL COMPOSITION: Polyvinyl polymer. REGISTERED USES: For use with 2,4-D ester or amine, piocloram, paraquat, simazine or dicamba for weed or brush control in non crop land. BENEFIT: Reduces drift, improves canopy penetration and foliage coverage. MODE OF ACTION: Reduces spray breakup and thus the number of fine driftable droplets. MIXING: 3-1000 mL/1000 L, depending on pressure, height and nozzle type. Add water and while agitating, add NALCO-TROL before adding liquid herbicides. Add wettable powder herbicides to water and ensure disperion before adding NALCO-TROL. UNIQUE CHARACTERISTICS: Product is extremely slippery; care should be taken when working on spray equipment and following a spill.

NAPROPAMIDE. TRADE NAMES: DEVRINOL 50W, DEVRINOL 10G. CHEMICAL FAMILY: Amide. CROP AND/OR NON-CROP REGISTRATIONS: Tomatoes, tobacco, strawberries, raspberries, blackberries, boysenberries, loganberries, established apples, grapes, peaches and pears, newly transplanted or established ornamentals, woody nursery stock, forest tree stock and container-grown ornamentals (see label for species). SENSITIVE WEEDS: Many annual weeds including crab grass, barnyard grass, annual blue grass, foxtails, sandbur, wild oats, goose grass, chickweed, groundsel, redroot pigweed, lamb's-quarters, purslane, prostrate knotweed, pineappleweed and prickly lettuce. UP-

TAKE AND TRANSLOCATION: Absorbed through the roots of germinating weeds. Translocated upward through seedling. BASIS OF SELECTIVITY: Metabolized by tolerant species. Root growth of germinating seedlings is inhibited. Established plants are not affected due to placement selectivity. APPLICATION METHODS: May be applied preplant incorporated using water as the carrier. Incorporation should be uniform, and to a chemical depth of 2.5 to 5 cm, using irrigation or proper incorporation equipment (e.g., tandem discs or field cultivator with sweep teeth) followed by a levelling device. On established crops, apply to a weed free soil surface and irrigate in if no rainfall occurs within 7 days after application in spring or fall, or within 2 days after application in summer; irrigate with sufficient water to wet the soil to a depth of 5 to 10 cm (ca. 7 mm). For post plant application in tobacco, apply in 25 cm band over the row. Cross-disc or cross-plow after harvest to dilute soil residue before planting cover crop. RESIDUAL ACTIVITY: Provides season long weed control if properly incorporated. Deep plowing will minimize any carryover effect. UNIQUE CHARACTERISTICS: Will not control germinated weeds. Resists leaching. To avoid injury to crops not registered for use with napropamide, do not plant until 12 months after the last napropamide application.

NAPTALAM. TRADE NAME: ALANAP CHEMICAL FAMILY: Amide. CROP AND/OR NON-CROP REGISTRATIONS: Cucumbers, melons, squash and pumpkins. SENSITIVE WEEDS: Seedlings of bindweed, chickweed, cocklebur, lamb's-quarters, pigweed, purslane, ragweed, velvetleaf, crab grass and foxtail. UPTAKE AND TRANSLOCATION: Inhibits seed germination and may be absorbed through the root system after germination. APPLICATION METHODS: Preemergence. Soil clods should be thoroughly broken up and pulverized to give a smooth surface before spray applicaton. Apply up to 48 hours after planting. Following applications the soil should not be disturbed unless later weed growth makes cultivation necessary. A second application may be applied to cucumbers and melons about one month after the first spray, when the crop has emerged but before the weeds are up. Use lower rates on light soil, higher rates on heavy soil. RESIDUAL ACTIVITY: Completely decomposes in 6-8 weeks. UNIQUE CHARACTERISTICS: Do not apply during very wet, cold weather as stunting of the crop may result. Avoid spray drift to areas planted to sensitive crops such as beets, tomatoes and spinach.

OIL. (See MINERAL OIL).

OXYFLUORFEN. TRADE NAME: GOAL CHEMICAL FAMILY: Diphenyl ether. CROP AND/OR NON-CROP REGISTRATIONS: Onions. SENSITIVE WEEDS: Purslane, pigweed, annual nightshades, wild buckwheat, lamb's-quarters. UPTAKE AND TRANSLOCATION: Primarily foliar absorption but some root absorption. Very little movement within the plant following foliar or root absorption. APPLICATION METHODS: Postemergence. Best control is obtained when weeds are in the 2 to 4 leaf stage and actively growing. The first application can be made when onions have 2 fully developed true leaves. Repeat applications may be necessary to control late germinating weeds. Use at least 500 litres of water per hectare. RESIDUAL ACTIVITY: Limited preemergence activity. UNIQUE CHARACTERISTICS: Use on dry bulb onions. Do not use when crop or weeds are under stress. Do not apply within 56 days prior to harvest.

PARAQUAT. TRADE NAME: GRAMOXONE CHEMICAL FAMILY: Bipyridylium. CROP AND/OR NON-CROP REGISTRATIONS: Apples, apricots, cherries, currants, gooseberries, grapes, high bush blueberries, peaches, pears and plums established more than one year; blackberries, loganberries and red raspberries; inter-row spraying in strawberries; stale seedbed technique for vegetables and field crops; inter-row directed chemical weeding for vegetable fields and established nursery crops; asparagus; potatoes; established alfalfa and bird's-foot trefoil; pasture renovation; zero tillage corn; conifer control; turf renovation; chemical mowing weed control in non crop land; aquatic weed control. SENSITIVE WEEDS: Non selective - affects all green plants. UPTAKE AND TRANSLOCATION: Absorbed by foliage and green bark; little or no translocation. BASIS OF SELECTIVITY: All green plant tissue is sensitive. Less effective on plants with a very waxy cuticle and linear leaf shape such as nutsedge. Safe on mature (non green) bark of woody plants. APPLICATION METHODS: Postemergence. Broadcast, or directed spray to avoid contacting leaves or bark of desirable plants. Apply when weeds are less than 15 cm high. Better results are usually obtained if application is made on a dull or cloudy day, or in the evening. RESIDUAL ACTIVITY: Essentially no residual activity in soil. Will persist in organic material such as mulches or turf thatch; therefore, do not reseed these areas for 5 days. More than one application per season may be necessary, especially for perennial weeds. UNIQUE CHARACTERISTICS: Inactivated by adsorption to soil particles. Not available to homowners. For a domestic registration, see paraquat/diquat.

PARAQUAT/ DIQUAT. TRADE NAMES: WEED AND GRASS KILLER, WEED-BAN. CHEMICAL FAMILY: Bipyridylium/bipyridylium. CROP AND/OR NON-CROP REGISTRATIONS: "Chemical mower" to control weeds on driveways, pathways and other non cultivated areas. SENSITIVE WEEDS: All green plant tissue. Less effective on plants with a thick, waxy cuticle such as nutsedge. UPTAKE AND TRANSLOCATION: Foliar contact activity. Little or no translocation. BASIS OF SELECTIVITY: No selectivity for green plants. Will not penetrate the mature (non green) bark of woody plants. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Essentially none; inactivated by adsorption to soil particles. May remain active in turf thatch after application, therefore, thorough cultivation of a turf area is required before seeding. UNIQUE CHARAC-

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

TERISTICS: Best results follow application on dull or cloudy days, or in the evening.

PARAQUAT/ SIMAZINE. TRADE NAME: TERRAKLENE CHEMICAL FAMILY: Bipyridylium/s-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Apples, pears, grapes, raspberries, high bush blueberries, asparagus, woody ornamentals and nursery stock, shelterbelts and non crop land. SENSITIVE WEEDS: Annual grasses and broadleaf weeds. UPTAKE AND TRANSLOCATION: Foliar absorption of paraquat but no translocation; simazine is absorbed by roots, and translocated to leaves and shoots. BASIS OF SELECTIVITY: Used only on established plantings. APPLICATION METHODS: Foliar postemergence spray directed away from green bark and desirable foliage. For asparagus, apply after weed emergence but before crop emergence. The best foliage burn will result when applied on a dull or cloudy day, or in the evening. RESIDUAL ACTIVITY: Up to a year, depending on rate. UNIQUE CHARACTERISTICS: The mixture provides a rapid burn of existing green plant tissue and residual control of germinating weeds. Should be used only under established plants. Lower rates should be used on sandy soil.

PEBULATE. TRADE NAME: TILLAM CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Tobacco, tomatoes, red beets and sugar beets. SENSITIVE WEEDS: Annual grasses (crab grass, barnyard grass, wild oats, foxtails), yellow nutsedge, horsetail and some annual broadleaf weeds. UPTAKE AND TRANSLOCATION: Absorbed by roots, hypocotyl and seed. Translocated upward to growing point. BASIS OF SELECTIVITY: Tolerant species degrade herbicide. Also food reserves in seed allow seedling to outgrow chemical effect. APPLICATION METHODS: Preplant incorporated. May be applied using water or liquid fertilizer as the carrier. Dry fertilizers may also be used as the carrier when impregnated by a licenced fertilizer dealer. Incorporate uniformly into the soil by setting the incorporation equipment (i.e. tandem disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are separate operations, application should be to a dry soil surface. RESIDUAL ACTIVITY: Provides season long weed control without soil residues the following season. UNIQUE CHARACTERISTICS: Rainfall is not required for activation. Leaching is not significant, even with heavy rainfall.

PENDIMETHALIN. TRADE NAME: PROWL CHEMICAL NAME: dinitroaniline. CROP and/or NON-CROP REGISTRATION: Direct seeded dry bulb onions grown on muck soil. SENSITIVE WEEDS: green foxtail, yellow foxtail, crab grass, barnyard grass, common chickweed, lamb's-quarters and pigweed. UPTAKE AND TRANSLOCATION: Weeds are controlled as they germinate. Translocation is not significant and emerged weeds are not controlled. BASIS OF SELECTIVITY: No significant uptake and translocation by the crop. APPLICATION METHODS: Postemergence to the crop at the loop and 2 leaf stage. RESIDUAL ACTIVITY: Persistence depends on weather and soil conditions (more persistent under dry conditions). Only onions may be grown in the year of application. Other crops may be grown 1 year following application. UNIQUE CHARACTERISTICS: Strongly adsorbed to soil particles. Most effective when rain or overhead irrigation is received with 7 days of application. Application at both crop growth stages is required for season long control. Sequential application of other herbicides may be required for broad spectrum control. Registered for use on muck soil only.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

PICLORAM/ 2,4-D. TRADE NAME: TORDON 101 MIXTURE CHEMICAL FAMILY: Pyridine/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Weed and brush (including conifer) control in non crop locations, industrial sites and rights-of-way. SENSITIVE WEEDS: Most broadleaf herbaceous weeds including Canada thistle, sweet and red clover, wild carrot, common ragweed, dandelion, goldenrodS, dock, plantain, prickly lettuce, burdock, fleabaneS and vetch; deciduous and coniferous woody plants except white ash. UPTAKE AND TRANSLOCATION: Rapidly absorbed by the roots, stems and foliage. Translocation can be up or down but like 2,4-D, accumulation is in young, rapidly growing meristematic tissue. BASIS OF SELECTIVITY: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species. APPLICATION METHODS: For deciduous and coniferous brush, apply either broadcast using a fixed nozzle (constant volume per hectare) or selectively using a spray gun (variable volume per hectare). As spray gun applications use a more dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed in spring or early summer. To ensure thorough coverage and minimize drift, brush to be treated should be less than 2.5 m tall. For cut surface treatment, mix with water or ethylene glycol (to reduce the freezing point, if necessary) and apply to cover the cambium layer of freshly cut stumps. For broadleaf herbaceous weeds, apply broadcast in spring or ealy summer after growth begins. RESIDUAL ACTIVITY: Soil residue carryover into the year following application is minimal when applied at recommended rates. Degradation is most rapid under warm, humid conditions. Because small residues of picloram in soil can be phytotoxic to crops such as soybeans, tobacco, tomatoes, potatoes, grapes and many desirable ornamental plants, picloram may not be applied to land used, or land that may be used, for the production of agricultural and horticultural crops. UNIQUE CHARACTERISTICS: A permit from the Ministry of the Environment is required for the purchase and use of picloram/2,4-D in Ontario. Picloram/2,4-D must not be applied over, or near, areas where roots of desirable trees or other plants may extend. Because spray drift is phytotoxic to sensitive plants, an approved drift control system or additive is recommended when making low volume applications adjacent to desirable trees or crops.

PROMETRYNE. TRADE NAME: GESAGARD CHEMICAL FAMILY: S-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Potatoes, carrots, peas and transplanted celery. SENSITIVE WEEDS: Lamb's-quarters, lady's-thumb, corn spurry, pigweed, wild mustard, purslane, eastern black nightshade, chickweed, hempnettle and green foxtail. UPTAKE AND TRANSLOCATION: Absorbed through foliage and roots. Translocated upwards through xylem accumulating in the apical meristems. BASIS OF SELECTIVITY: Metabolized by tolerant plants and to a lesser extent by sensitive plants, although this is not thought to be the major selective mechanism. APPLICATION METHODS: Preemergence or early postemergence (before weeds are 5 cm high). Apply before potatoes, carrots or peas emerge. Apply 7 to 14 days after celery is transplanted. RESIDUAL ACTIVITY: About 6 to 8 weeks. A fall cover crop of rye or oats may be sown on the treated land in the same season.

PROPANIL/ MCPA. TRADE NAME: STAMPEDE CM CHEMICAL FAMILY: Acetanilide/phenoxy. CROP AND/OR NON-CROP REGISTRATIONS: Spring wheat, barley and oats. SENSITIVE WEEDS: Green and yellow foxtail; certain broadleaf weeds such as wild buckwheat, lady's-thumb and pale smartweed. UPTAKE AND TRANSLOCATION: Propanil is absorbed by leaves; translocated to growing point of shoot and then back to other leaves. MCPA is absorbed by leaves; translocated to growing points of shoot and root. BASIS OF SELECTIVITY: Faster metabolism of herbicide by tolerant species. APPLICATION METHODS: Postemergence. Best control is obtained when weeds are small and actively growing, relative humidity is high and daily maximum temperature exceeds 21°C. Apply when cereals are in the 2 to 5 leaf stage and weeds are in the 1 to 4 leaf stage. Do not apply if daily maximum temperature is not expected to exceed 10°C or if frost is expected within 24 hours. Thorough spray coverage is necessary. RESIDUAL ACTIVITY: None. UNIQUE CHARACTERISTICS: May cause crop yellowing or tip burn but these effects are temporary and normally disappear in 10 to 14 days.

PROPYZAMIDE. TRADE NAME: KERB CHEMICAL FAMILY: Amide. CROP AND/OR NON-CROP REGISTRATIONS: Alfalfa, bird's-foot trefoil, woody nursery stock, apples, pears, low bush blueberries. SENSITIVE WEEDS: Perennial grasses including quack grass, annual grasses, volunteer cereals and common chickweed. UPTAKE AND TRANSLOCATION: Taken up by plant roots and translocated to the foliage. Little foliar absorption. BASIS OF SELECTIVITY: Faster degradation in tolerant species. APPLICATION METHODS: Preemergence to annual weeds. Postemergence control of perennial grasses when applied in the fall. Apply in the fall from late September to early November when the soil temperature is low but above freezing, and soil moisture is high. RESIDUAL ACTIVITY: Persistence is variable (2 to 9 months), depending on soil type and climatic conditions. Decomposition of the herbicide is slow at temperatures below 15°C but accelerates at temperatures above this level. Persistence is greatest in sandy soils with low organic matter. UNIQUE CHARACTERISTICS: Rainfall or irrigation is required after application to move the herbicide into the root zone for uptake by perennial grasses and germinating annual grasses.

PYRAZON. TRADE NAME: PYRAMIN FL CHEMICAL FAMILY: Pyridazinone. CROP AND/OR NON-CROP REGISTRATIONS: Sugar beets and table beets. SENSITIVE WEEDS: Annual nightshades, chickweed, knotweed, lady's-thumb, lamb's-quarters, oak-leaved goosefoot, prostrate pigweed, purslane, ragweed, redroot pigweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, wild carrot (seedling), wild mustard, wormseed mustard and yellow rocket (seedling). UPTAKE AND TRANSLOCATION: Can be taken up by both roots and leaves, but translocation is upward to leaves where it inhibits photosynthesis. BASIS OF SELECTIVITY: Metabolism by tolerant species. APPLICATION METHODS: Preplant incorporated, preemergence, or postemergence after the second true leaf stage of the beets. RESIDUAL ACTIVITY: Average persistence is about 4 to 8 weeks in soil, depending on soil moisture and temperature. Residue carryover problems are unlikely. UNIQUE CHARACTERISTICS: With preemergence applications, at least 1.25 cm of rainfall is required for good weed control. Combinations of pyrazon and TCA are most useful where both annual broadleaf weeds and grasses are a problem. These treatments may not be effective on high organic soils or dry soils (i.e. muck soils or with late planted beets when soils are drier). Under these circumstances, postemergence applications of pyrazon plus TCA as a band over the row may be most effective. However, to be selective and effective the chemicals must be applied after the cotyledons of the beets are 2.5 cm long and before the weeds have reached the 4 true leaf stage (10 cm). Where TCA has been used, beet tops should not be fed to livestock. TCA residues in the soil can be a problem for some crops such as corn.

PYRIDATE. TRADE NAME: LENTAGRAN CHEMICAL FAMILY: Phenyl pyridazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn (field, sweet, seed), tomato. SENSITIVE WEEDS: Annual broadleaf weeds (1-4 leaf stage) including triazine-resistant species, certain annual grasses (1-3 leaf stage) when the weeds are actively growing. Pyridate alone: lamb's-quarters, redroot pigweed. Pyridate plus atrazine on corn and pyridate plus metribuzin on tomatoes: lamb's-quarters, redroot pigweed, nightshade, purslane, ragweed (common), wild mustard, velvetleaf and suppression of buckwheat (wild), lady's-thumb (smartweed), barnyard grass, crab grass (hairy), foxtail (green and yellow). Where heavy annual grass pressure is a problem, use a specific

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

preemergence grass herbicide. UPTAKE AND TRANSLOCATION: Rapidly absorbed by leaves and acts as a contact only. BASIS OF SELECTIVITY: It penetrates into both sensitive and tolerant plants but is quickly metabolized and inactivated in tolerant crops such as corn,. In sensitive weeds, activity is evident by marginal yellowing, followed by yellowing and browning of the entire leaf. This visible evidence generally occurs within 4-7 days after application. Activity is more rapid at higher temperatures and under good growing conditions. Weed control under drought conditions may be decreased. APPLICATION METHODS: Postemergence. Sprays can be applied overall on corn and directed on transplanted tomatoes. RESIDUAL ACTIVITY: None. UNIQUE CHARACTERISTICS: Combination with triazine herbicides improves total weed control. The stage of the weed determines application date and not the stage of the corn. Tomatoes will show temporary yellowing which is reduced by directing the spray to the bottom one-third (1/3) of well established tomato plants. Uptake by leaves is very rapid and rainfall shortly after application (1-2 hours) has little effect on the degree of control.

QUIZALOFOP-ETHYL. TRADE NAME: ASSURE. CHEMICAL FAMILY: Pyridoxyphenoxypropionate. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans, flax, canola and seed alfalfa. SENSITIVE WEEDS: Annual grasses, volunteer oats, wheat, barley and quack grass. UPTAKE AND TRANSLOCATION: Is rapidly absorbed and readily translocated in both the xylem and phloem from the treated foliage to the root systems and growing points of the plant. BASIS OF SELECTIVITY: Disruption of fatty acid biosynthesis leading to increased permeability and cellular disruption in sensitive plants. Rapid metabolism of the active herbicide in tolerant species. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Rapid microbial degradation and essentially no soil activity. UNIQUE CHARACTERISTICS: The 1.0 L/ha rate controls all annual grasses and volunteer cereals. Excellent activity on quack grass.

SETHOXYDIM. TRADE NAME: POAST CHEMICAL FAMILY: Unique. CROP AND/OR NON-CROP REGISTRATIONS: Canola (rapeseed), flax, soybeans, dry beans, snap beans, peas, onions, tomatoes, potatoes, cucumbers, alfalfa, lima beans, faba beans, adzuki beans, mung beans, buckwheat, creeping red fescue and garlic. SENSITIVE WEEDS: Annual grasses (wild oats, foxtails, barnyard grass, large crab grass, proso millet, fall panicum and witch grass), volunteer corn and cereals, and quack grass. UPTAKE AND TRANSLOCATION: Absorbed by foliage. Translocated upwards and downwards in plant. BASIS OF SELECTIVITY: Degraded by tolerant species (broadleaf plants). APPLICATION METHODS: Postemergence to actively growing annual grasses in the 1 to 6 leaf stage and quack grass in the 1 to 3 leaf stage. Use flat fan nozzles and add ASSIST OIL CONCENTRATE to the spray mix. Lower rates may be used for quack grass control in flax, potatoes, soybeans, canola and alfalfa when ammonium sulphate is added to the spray mix. Alternatively, MERGE may be used for improved quack grass control instead of ASSIST OIL CONCENTRATE or Ammonium sulphate plus ASSIST OIL CONCENTRATE. Other postemergence herbicides which are not recommended as tank mix combinations on the label must be applied at least 4 days before or after sethoxydim application. Aerial application is also registered. RESIDUAL ACTIVITY: Essentially none. A second application and/or cultivation may be necessary to control grasses which emerge after treatment. UNIQUE CHARACTERISTICS: Susceptible grasses, when sprayed, stop growing immediately and then gradually turn yellow to purple to brown over a period of 7 to 21 days, depending on growing conditions and crop competition. Rainfall within one hour after application may reduce effectiveness. If treated grasses are stressed (drought, flooding, prolonged cool temperatures) control will be delayed or reduced.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

SIDURON. TRADE NAME: TUPERSAN. CHEMICAL FAMILY: Substitued urea. CROP AND/OR NON-CROP REGISTRATIONS: Lawns and turf. For use in established plantings of blue grass, fescue, redtop, smooth brome, perennial rye grass, orchard grass and certain strains of bent grass (PenCross, Seaside, Highland, Astoria, Nimisila, C-1, C-7, and C-19). SENSITIVE WEEDS: Germinating annual grasses such as crab grass, barnyard grass and foxtail. UPTAKE AND TRANSLOCATION: Readily absorbed through roots, less so through foliage. Translocates in xylem. BASIS OF SELECTIVITY: Root growth inhibition in germinating sensitive species. Sensitive species affected only in seedling stage. APPLICATION METHODS: Preemergence; in spring just before expected emergence of annual weedy grasses. The only formulations available are one combined with a fertilizer. RESIDUAL ACTIVITY: No evidence of residues in soil after one year. UNIQUE CHARACTERISTICS: Will cause damage to some bent grass strains.

SIMAZINE. TRADE NAMES: PRINCEP NINE-T, SIMADEX, SIMAZINE. CHEMICAL FAMILY: S-triazine. CROP AND/OR NON-CROP REGISTRATIONS: Corn, established asparagus, bird's-foot trefoil, raspberries, loganberries, blackberries, high bush blueberries, alfalfa, apples apricots, peaches and pears established for one year or more; grapes established for 3 or more years; shelterbelts established for at least one growing season (caragana, green ash, Siberian elm, American elm and Manitoba maple); new or established Christmas tree and woodland plantations (2 year or older white pine and balsam fir); woody ornamentals and nursery stock established for at least one year (cedar, barberry, apple, flowering crab apple, box wood, cotoneaster, dogwood, holly, rose, yews, chamaecyparis, hemlock, juniper, multiflora rose, peony; spruce, mugho pine, black walnut and white ash); nursery container stock (cedar, juniper, yew); aquatic weed control; non crop land. Conifer site preparation before planting of fir, pine and spruce (Princep Nine-T only). SENSITIVE WEEDS: Annual broadleaf weeds such as pigweed, lady's-thumb, lamb's-quarters, purslane, ragweed, volunteer clover, wild buckwheat, smartweed, plantain and groundsel; annual grasses such as barnyard grass, crab grass, wild oats and yellow foxtail (triazine-resistant biotypes of foxtail, lamb's-quarters, pigweed and groundsel will not be controlled); most perennial species starting freshly from seed; pond scums and filamentous algae such as Chara and Nitella, most emerged and submerged aquatic vegetation. UPTAKE AND TRANSLOCATION: Absorbed by roots; little or no foliar absorption; translocated upwards in xylem, accumulating in apical meristem and leaves. BASIS OF SELECTIVITY: Some species, such as corn, metabolize simazine. In most crops, selectivity is based on the roots of the crop plants being deeper than the depth to which simazine leaches. APPLICATION METHODS: Preplant incorporated (to a depth of 2.5 cm) or preemergence in corn; preemergence in other crops. Broadcast or band application. In fruit crops, apply a one metre wide band under the plants; cultivate or sod the area between the rows. For aquatic weed control, apply as a draw down treatment or water volume application in drainage ditches and ponds with no water flow through. RESIDUAL ACTIVITY: Soil residues may persist for more than one season. After spraying with simazine, do not plant any crop in the treated area in the same year except corn. Where rates in excess of 2 kg/ha have been applied, do not plant rotational crops in the following year; soils should be tested if there is any question of excessive residues remaining. UNIQUE CHARACTERISTICS: Needs sufficient moisture to be activiated. Should be applied only once per season. To avoid build up of resistant weeds, simazine should be rotated with other non triazine residual herbicides. Simazine is more persistant than atrazine. Where rainfall is sufficient to cause erosion, soil containing simazine may wash to lower areas of land and injure existing or subsequent crops.

SPRAY ADJUVANT DEFOAMER. TYPE OF ADJUVANT: Defoamer. CHEMICAL COMPOSITION: Dimethylpolysiloxane. REGISTERED USES: To reduce foaming in spray mixes of atrazine. BENEFIT: Reduces foaming. MIXING: To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates. UNIQUE CHARACTERISTICS: Do not use with any other herbicide or herbicide/adjuvant mixture.

SURFACTANTS. (See AGRAL 90, AG-SURF, COMPANION, CANPLUSS 411,CITOWETT PLUS, ENHANCE, FRIGATE, MERGE).

TCA. TRADE NAME: NATA GRASS KILLER PELLETS CHEMICAL FAMILY: Trichloroacetic acid. CROP AND/OR NON-CROP REGISTRATIONS: Barley, oats, red beets, non crop land. SENSITIVE WEEDS: Annual grasses, quack grass and conifers. UPTAKE AND TRANSLOCATION: Absorbed more rapidly by roots than by foliage. Translocates readily and accumulates in growing tissues. BASIS OF SELECTIVITY: Differential growth inhibition. APPLICATION METHODS: In oats and barley, postemergence to grasses and crop; in beets, preemergence to crop; on non crop land pre or postemergence to grasses; for conifer control, foliar application. RESIDUAL ACTIVITY: About 3 to 10 weeks depending on rate applied, soil moisture and temperature conditions.

TEBUTHIURON. TRADE NAMES: HERBEC 20 P, SPIKE 80 WP, SPIKE 5 G. CHEMICAL FAMILY: Substituted urea. CROP AND/OR NON-CROP REGISTRATIONS: Total vegetation control, or selective control of undesirable cut or standing brush in non crop land or non landscaped areas. SENSITIVE WEEDS: Only a few plant species, such as horsetail, are not controlled with tebuthiuron but rate requirements vary depending on the weed or brush species. UPTAKE AND TRANSLOCATION: Readily absorbed by the roots, translocated upward to leaves where it most likely acts as a photosynthetic inhibitor. BASIS OF SELECTIVITY: Few if any plants show physiological tolerance. APPLICATION METHODS: For total vegetation control, apply prior to, or during, the period of active plant growth. Control is enhanced by rainfall. For selective control of trees or stumps, apply tebuthiuron to the soil at the base of the stems. UNIQUE CHARACTERISTICS: Do not apply tebuthiuron on, or near, desirable trees or other vegetation, or on areas where roots of desirable plants may penetrate, or in locations where the chemical may be washed into contact with desirable plants. To avoid lateral movement, do not apply to frozen or snow covered soil, or when heavy rainfall is expected soon after application.

TERBACIL. TRADE NAME: SINBAR CHEMICAL FAMILY: Uracil. CROP AND/OR NON-CROP REGISTRATIONS: Strawberries, high bush blueberries, apples, peaches and alfalfa. SENSITIVE WEEDS: Barnyard grass, blue grass, crab grass, foxtail, chickweed, cheat grass, perennial rye grass, wild barley, mustard, prickly lettuce, stinkweed, annual sow-thistle, henbit, lamb's-quarters, pigweed, purslane and ragweed. Partial control of quack grass, horsenettle, vetch and yellow nutsedge. UPTAKE AND TRANSLOCATION: Uptake is mostly through roots, although partially through foliage and stem. Translocation is upward into leaves. BASIS OF SELECTIVITY: Used only on established plantings so that roots of crop are below depth to which chemical penetrates. May also be slower translocation and faster degradation in tolerant species. APPLICATION METHODS: Apply to the soil surface in 200-1000 L water per hectare. Alfalfa must be dormant. If weed growth is present in apples, paraquat may be mixed with spray. Rates for strawberries are considerably lower and can be applied in spring, post harvest or late fall. Control of perennial grasses may be improved by cultivation prior to treatment. RESIDUAL ACTIVITY: May be up to 2 years. Residues are likely to be higher on heavier soil types if higher rates and repeated applications are used. UNIQUE CHARACTERISTICS:

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

Moisture is necessary to activate the chemical within 2 weeks after application. Do not apply on soils with less than 1% organic matter, nor on eroded soil areas. Use lower rates on soils with 1 to 2% organic matter. Do not apply on weak or diseased strawberry plants.

THIFENSULFURON- METHYL. TRADE NAME: PINNACLE. CHEMICAL FAMILY: Sulfonyl urea. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans. SENSITIVE WEEDS: Redroot pigweed, lamb's-quarters, velvetleaf, lady's-thumb and wild mustard. UPTAKE AND TRANSLOCATION: Following foliar application, is rapidly absorbed and translocated in both xylem and phloem. BASIS OF SELECTIVITY: Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert to nonphytotoxic metabolites. APPLICATION METHODS: Postemergence. RESIDUAL ACTIVITY: Rapid soil microbial degradation. Half-life of 5 days at 25°C soil temperatures. UNIQUE CHARACTERISITICS: Labelled species can be controlled up to 10 cm in height. Redroot pigweed is very sensitive. Typical symptoms of plant death (leaf crinklin, curling, chlorosis) occur 5-10 days after application depending on the growing conditions. Velvetleaf control is greatly enhanced by the inclusion of ammonium containing fertilizer such as a UAN solution.

TRIALLATE. TRADE NAME: AVADEX BW CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Spring wheat and barley, flax, rapeseed, sugar beets, mustard and dry peas. SENSITIVE WEEDS: Wild oats. UPTAKE AND TRANSLOCATION: Absorbed mainly by the coleoptile of wild oats. APPLICATION METHODS: Postplant incorporated (spring wheat and barley). Preplant incorporated (barley, flax, rapeseed, sugar beets, mustard and dry peas). For postplant treatment of the cereals, the spray is applied to the soil after the crop is seeded and then thoroughly worked into the soil by harrowing twice, the second harrowing at right angles to the first; the crop should be seeded uniformly, deep enough so it is not disturbed by the harrow. For preplanting treatments, the chemical is sprayed on the soil surface and worked into the top 5 to 8 cm of soil with a disk or cultivator implement. The crop can be seeded anytime after treatment. In all treatments, the chemical should be worked into the soil within 2 hours after spraying. RESIDUAL ACTIVITY: Half-life in soil of approximately 6-8 weeks.

TRICLOPYR. TRADE NAME: GARLON 4, RELEASE. CHEMICAL FAMILY: Pyridine. NON-CROP REGISTRATIONS: Triclopyr herbicide is recommended for the control of unwanted woody plants and annual and perennial broadleaved weeds in non crop areas including rights-of-way, electrical power lines, communication lines, pipelines, roadsides and manufacturing and storage sites. Release silvicultural herbicide is recommended for the control of undesirable woody plants and annual and perennial broadleaved weeds in woodland management. SENSITIVE WEEDS: Woody plant species controlled are: alder, ash, aspen, basswood, beech, birch, blackberry, raspberry, buckthorn, cottonwoood, dogwood, elderberry, hawthorn, hickory, hop-hornbeam, locust, maples, mulberry, poison oak, poplar, sumac, willow, honey locust, choke cherry, elm, red maple, oaks and pines. Annual and broadleaved weeds controlled are: burdock, chicory, curled dock, dandelion, field bindweed, lamb's-quarters, ragweed, smartweed, smooth bedstraw, vetch and wild lettuce. UPTAKE AND TRANSLOCATION: Triclopyr is absorbed by both plant leaves and roots. It is readily translocated through plants. It tends to accumulate in meristematic tissues and is not readily metabolized in susceptible plants. BASIS OF SELECTIVITY: Tolerant species such as grasses rapidly metabolize triclopyr. APPLICATION METHODS: For deciduous and certain conifer species use as a foliage spray when brush species are actively growing. Apply either broadcast using a fixed nozzle (constant volume per hectare) or selectively using a spray gun (variable volume per hectare) as spray gun applications use a dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed and actively growing. For conifer release in woodland sites, application should be made in late summer after conifers have hardened off and deciduous trees are in full leaf but prior to autumn coloration. Woody plants may also be controlled by using basal bark, dormant stem and cut surface treatments. RESIDUAL ACTIVITY: Half life in soil is approximately 30 days under conditions that are favorable for microbial decomposition. UNIQUE CHARACTERISITICS: Applications should be made only when there is little or no hazard from spray drift. Small quantities of spray drift may injure susceptible broadleaved plants.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

TRIFLURALIN. TRADE NAMES: RIVAL, TREFLAN, TRIFLUREX 40 EC. CHEMICAL FAMILY: Dinitroaniline. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans, dry beans (white or kidney), faba beans, snap beans, lima beans, black beans, canola (rapeseed), triazine-tolerant canola (variety of O.A.C. Triton, pedigreed seed only), sunflowers, turnips, peas (field and canning), direct seeded alfalfa; transplants of tomatoes, peppers, Brussels sprouts, broccoli, cabbage and cauliflower; carrots, crambe, direct seeded cabbage and cauliflower, annual flowers, woody nursery stock, perennials, established shelterbelts, strawberries. SENSITIVE WEEDS: Effective on most annual grasses, and will provide good control of pigweed and lamb's-quarters, including the triazine-tolerant biotypes of these weeds. UPTAKE AND TRANSLOCATION: No significant absorption or translocation of trifluralin in crops grown in soil treated with trifluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled. BASIS OF SELECTIVITY: Physiological growth processes associated with seed germination. APPLICATION METHODS: Preplant incorporated. apply in 100-300 L of water per hectare. Use lower rate of the chemical on sandy soils and increased rate for loam to clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or tine cultivator (10-13 km/hr) set to work 8 to 10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed 8 to 24 hours, depending on label directions. The second incorporation is recommended anytime before planting. Activated upon incorporation; rainfall is not required. RESIDUAL ACTIVITY: Recommended application rates provide season long weed control. Succeeding crops, even fall seeded grain crops planted in soil that received trifluralin the preceding spring, will not be injured under normal conditions. UNIQUE CHARACTERISTICS: Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate. Does not control ragweed, annual nightshades or mustards; lady's-thumb may escape.

VERNOLATE. TRADE NAME: VERNAM CHEMICAL FAMILY: Thiocarbamate. CROP AND/OR NON-CROP REGISTRATIONS: Soybeans and peanuts. SENSITIVE WEEDS: Annual grasses such as crab grass, barnyard grass and foxtails; yellow nutsedge. UPTAKE AND TRANSLOCATION: Uptake by roots, hypocotyls and germinating seeds. Translocation upwards to growing tip. BASIS OF SELECTIVITY: Tolerant species break down venolate more rapidly. Also, food reserves in seed allow seedling to outgrow herbicide effect. APPLICATION METHODS: Preplant incorporated. Apply using water or liquid fertilizer as carrier. Incorporate uniformly into soil by setting the incorporation equipment (i.e. tandem, disks, field cultivator with sweep teeth or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. If application and incorporation are separate operations, apply chemical to dry soil surface and incorporate within 4 hours. RESIDUAL ACTIVITY: Provides season long weed control with no soil residues the following year to prevent crop rotation. UNIQUE CHARACTERISTICS: Does not need rainfall to be activated and will not leach significantly under heavy rainfall. Under unfavorable growing conditions, leaf crinkling may be observed but this usually does not affect yield.

WATER SOLUBLE DYES. See AQUASHADE.

NOTE: Trade names and common names of herbicide are cross-referenced in Table 1.

APPLICATION TECHNOLOGY

INTRODUCTION - Herbicide application can and should be a precision operation. Recent advances in equipment and control systems can make the job relatively simple and precise.

Pesticides applied incorrectly may result in wasted pesticide, poor or no control, damage to crops (possibly the neighbor's) or environmental contamination. Every effort must be made to apply chemicals properly to help eliminate these undesirable effects.

DEVELOPMENTS IN NEW EQUIPMENT - The need for applicators to acurately apply herbicides has led equipment manufacturers to work more closely with the crop protection industry to refine application systems. New concepts, such as closed injection type systems with herbicide concentrate separate from the water carrier, are being investigated. Better monitoring of application is currently available using automatic sprayer controllers with computer technology. This technology has also included radar to indicate accurate ground speed, which is common among the professional custom applicators.

The industry has gone through several stages to get to this point and is currently working towards the closed injection system. Work is being continued in the area of drift reduction with air assists and electrostatic methods.

SPRAYERS FOR HOME USE - A 9 to 14 L knapsack or compressed air garden sprayer is satisfactory for use on lawns and around the home. A nozzle tip which produces a fairly coarse spray will help reduce spray drift. Care should be taken to keep the pressure relatively low since pressures up to 700 kPa can easily be obtained. High pressures produce more very small spray droplets which can drift in light winds to susceptible garden plants. The sprayer should be reserved for use with herbicides and should NOT be used to apply insecticides or fungicides.

FIELD SPRAYERS - The most common sprayer used in herbicide application is the boom type sprayer. This sprayer applies an even swath of herbicide across the width of the boom.

The main requirements for field spraying are: (1) a uniform pressure, (2) a uniform forward speed, (3) a stable boom height to assure uniform overlap of the nozzle tip patterns, and (4) an application rate between 55 and 450 L/ha.

Most commercially built sprayers can be adapted and used safely to apply liquid fertilizers. Extra agitation may be required. It is up to the individual to assure that the sprayer components being used are compatible with the fertilizer formulation and follow the manufacturer's recommendations.

AIR BLAST or MIST SPRAYERS - These machines should never be used to apply herbicides, especially hormone type herbicides such as 2,4-D. The danger of causing herbicidal damage at a great distance from the treated area is very great.

AERIAL APPLICATION of herbicides may be used where large acreages of a crop are grown in a solid block provided susceptible crops are not nearby. Application of hormone type herbicides (see glossary) by aircraft is NOT recommended in areas of intensive agriculture where susceptible crops may be damaged

Aerial applicators must be licenced by the Ontario Ministry of the Environment to apply pesticides. In addition, permits are required from the Ontario Ministry of the Environment under the authority of the Pesticides Act for the application of Schedules 1 and 5 herbicides and Schedule 2 hormone type herbicides. Inspection will be conducted by Ministry Personnel to ensure safety of application.

It is an offense under the Federal Pest Control Products Act to use a control product under unsafe conditions. Precautionary measures must be taken at all times to prevent drift (see Section on Drift of Herbicides).

CARE AND USE OF EQUIPMENT

SPRAYING SPEEDS - Since the application rate for most agricultural and roadside herbicide applications must be uniform, it is imperative that the forward speed of a sprayer be constant whenever liquid is being delivered by the nozzles. If the driving wheels of a tractor slip on the soil surface, the tractor's speedometer does not indicate a change in forward speed. To be certain that the forward speed is constant in spite of wheel slippage on hills, use an independent speedometer equipped with a ground driven wheel. Spray monitors and other electronic rate controllers may be installed. These automatically correct for variation in tractor speed to maintain a constant rate of application.

WATER - Use only clean water that has all debris, sand and mud removed from it. Never allow the intake screen to rest on the bottom of a farm pond while filling a sprayer. The intake line near the screen must, by law, be equipped with a check valve or anti-backflow device to prevent contamination of the pond or stream when the pump is shut off. The use of a tank refilling nozzle, volume booster nozzle or injection pump to aid in refilling the sprayer tank from farm ponds or streams should be avoided. These tank refilling aids may cause pond or stream contamination.

Where a farm water supply is used you should use a frost free water hydrant located outside the building equipped with a anti-backflow valve/siphon to be installed on the discharge end of the hydrant.

AGITATION - When chemical formulations in solution are used (2,4-D and water) at least 2 to 14 L/min. should be returned to the tank for agitation within the tank. Higher rates will apply with wettable powders. The return or bypass line from the pressure regulator should deliver the liquid to the bottom (not the top) of the tank to be effective.

When wettable powders (atrazine, etc.) are used, the return to the tank should be 14 to 27 L/min. for each 450 L of tank capacity, depending on the concentration of the wettable powder and the size of the tank. A special line from the pressure side of the pump (not the pressure regulator) to the tank must be used to carry the 14 to 27 L/min. necessary for hydraulic agitation in the tank using a Venturi Jet or sparge tube. This flow can be reduced if the sprayer has a mechanical agitator. Sparge tube agitation requires more water than venturi to give the same agitation.

To prepare a tank mix of wettable powder and an oil or emulsifiable concentrate, proceed as follows unless specific instructions are given on the product label:

1. Fill the sprayer tank with water to the half full mark.
2. Start the agitator and pour in a premixed slurry of wettable powder and water.
3. Agitate for 2 to 3 minutes before adding more water.
4. Add the oil or emulsifiable concentrate last.

Avoid excessive agitation of the mixture, as it may turn into a grease like mass which will settle to the bottom of the tank. The mixture may foam excessively.

To prevent a buildup of oil in the sprayer, the tank should be emptied completely before refilling. After any break in the spraying operation agitate thoroughly before proceeding. Clean the tank and sprayer immediately after use with a detergent or solvent and flush with clean water.

PUMPS - The heart of the sprayer is the pump. It should have adequate capacity to maintain the desired pressure, volume and agitation. Piston, diaphragm and centrifugal pumps are best suited for pumping wettable powder suspensions. For liquid herbicide applications, roller pumps may also be used in addition to the above types. When used for wettable powders or flowable formulations, choose a pump with an abrasion resistant housing. Read the manufacturer's care and storage instructions to gain optimum pump performance.

CAUTION: Running a spray pump without water, may cause damage or premature wear.

NOZZLE TIPS - Care should be taken to maintain a stable boom height to assure uniform overlap of the tip patterns to prevent missed weeds in the target height area.

The quality of the spray application is dependent on the quality of the nozzle tips and uniformity of the pattern. Both machined orifice and moulded orifice tips are available on the market. The spray pattern of these tips should be examined prior to their use.

Materials used for nozzle tips range from brass, stainless steel and hardened stainless steel to non metals such as plastics and ceramics. All formulations cause wear of the nozzle orifice, wettable powders more than others.

Sprayers should be calibrated frequently. (See sprayer calibration following.)

Nozzle tips are expendable items and should be replaced when they deliver 10% more than they did when new. Worn nozzle tips provide uneven distribution of solution and changes in spray pattern. They can also produce streaks across the field by delivery of too much herbicide to a given area.

Flat-Fan Nozzle Tips are the best for boom type sprayers used for applying herbicides. Spraying pressure should be maintained at 275 kPa for standard flat fan elipitical orifice tips.

By using 110 instead of 80 series of flat-fan nozzle tips and maintaining the same 51 cm spacing and same height as the 80 tips the pattern will be in full overlap. This reduces misses should the boom bounce as the spray travels over rough ground. This nozzle type may be color coded for size, i.e. output. Some of these color coded tips have stainless steel, ceramic or plastic inserts. Other tips can be useful for special application. Details on spacings, height of boom and pressures should follow manufacturer's recommendations.

Special **even spray nozzle tips** are available for band applications of herbicides. The width of the sprayed band is controlled by the height and spray angle of the nozzle tips as well as its orientation to the direction of travel. Manufacturer's literature and directions should be followed explicitly.

Flooding-fan nozzle tips are used at low pressures and, because of their wide spray angle, can be used closer to the ground surface, thus reducing the drift hazard. The distribution of herbicidal materials may not be as uniform with flooding-fan nozzle tips as with the flat pattern tips. Flooding fan nozzle tips are available in brass, plastic and stainless steel. Half as many of these nozzle tips are required to cover the same width as would be required with flat-fan nozzle tips. Sprayers equipped with a **broadcast type** of nozzle cover a wide swath. They are especially convenient for farm lane and fencerow spraying where a uniform spray pattern is not essential. The spray pattern is affected by wind and severe drifting may occur with even a light breeze. Never use a broadcast type of nozzle to spray near a susceptible crop.

Full or hollow cone nozzle tips may be used for applying herbicides to the soil surface when the herbicide is incorporated or mixed into the soil with a disk harrow, cultivator or similar tillage implement.

NOTE: When using any nozzle for spraying wettable powders, it is essential to calibrate the sprayer frequently because as a nozzle wears, the quantity of spray material delivered **increases** and distribution is not even. Uniform pattern distribution of the nozzle is of prime importance in nozzle selection.

There are various types of screens available including ball-check and plain screens. DO NOT MIX the sreen types in a spray boom since there is a difference in liquid flow through to the nozzle. The ball-check screens are an effort to have dripless nozzles. Diaphragm check valves on each nozzle work better towards a dripless boom.

To clean nozzle screens they must be removed from the nozzle body and washed thoroughly with soap and water using a bristle brush. Simply flushing water through the boom and nozzles will not remove some pesticide residue which has built up on the nozzle screens.

CLEANING THE SPRAYER - Prior to cleaning the sprayer there may be surplus tank mix to dispose of. As suggested in The Grower Pesticide Safety Course, one method of disposal of such surplus tank mix is to dilute the remaining spray solution at least 10 to 1 with water. This diluted solution can be applied to the previously treated area *as long as the maximum recommended product rate on the label is not exceeded.*

Pump at least 225 L of clean water through the sprayer at the end of the day or when changing from one herbicide to another. Clean the nozzle tips and all screens at the same time. This will help reduce the gummy deposits or the wettable powder accumulations in the sprayer. Wash the sprayer immediately after each use.

Equipment that has applied 2,4-D, MCPA or related herbicides should not be used to spray fungicides or other materials on susceptible crops, and should not be parked or stored near greenhouses or other areas where susceptible crops are grown. If the sprayer has a good tank and connecting hoses, and has been used to apply only the amine or sodium salt formulations of 2,4-D, etc. (not the ester), it may be used fairly safely on susceptible crops following a thorough cleaning of tank, hoses, boom nozzles, etc., with a strong (preferably hot) solution of a dtergent or alkaline cleaner, followed by a thorough rinsing with clean water. See Agriculture Canada Publication 1482, *Field Sprayers.*

The wash water contains herbicide. Never allow the wash water to run into a farm pond, stream, or other water source.

SPRAYER CALIBRATION

(Determining application rates in litres per hectare)

There are many ways of determining the number of litres of spray material that is being applied to one hectare of land - or calibrating a sprayer. Here are two methods that are straight forward and the resulting calculations are relatively simple.

Method 1 (according to OMAF videotape on calibration using a graduated cylinder in millilitres)

1. Set out two stakes 50 m (164 ft.) apart in the field or along fence row beside the field. Select gear and throttle setting on tractor that will be used while spraying. With sprayer half full of water do a test run to determine the time in seconds required to travel the 50 m course. Repeat at least three times to get an average time. Do not travel in previous wheel tracks in the field.
2. Mark or note throttle setting and/or rpm's on tachometer. In fact, it is best not to change throttle upon stopping for next step.
3. Operate sprayer while stationary at the desired pressure and the same throttle setting or rpm's as in the test run. Collect the spray in a graduated cylinder (mL) from each nozzle for the same length of time required to travel 50 m. Average output per nozzle in millilitres. If each nozzle is tested, then worn nozzles can be identified.
4. Clean or replace any nozzle that is more than 5% of the average nozzle output. Reinstall cleaned or new nozzle and recalibrate.
5. Measure your nozzle spacing on the boom in metres.
6. Application rate (litres/ha)
   $$= \frac{\text{mL liquid per nozzle}}{\text{nozzle spacing (metres)}} \times 0.2$$
7. Conversion factors:
   L/ha x 0.4 = L/acre
   L/ha x 0.11 = U.S. gal/acre
   L/ha x 0.09 = Imp. gal/acre
8. Check calibration rate in field with herbicide in spray solution in sprayer because the nature of the herbicide or amount of herbicide in tank sometimes affects flow rate compared to using just water while calibrating.

Sample Calculation

Average time to travel 50 m (164 ft.) 24.5 seconds
Average amount of liquid collected per nozzle for 24.5 seconds = 525. mL
Nozzle spacing on the boom = 0.5 metres (approximately 20 inches)
Application rate = $\frac{525\ \text{mL}}{0.5\ \text{M}} \times 0.2 = 210$ L/ha
210 L/ha x 0.4 = 84L/acre. 210 L/ha x 0.11 = 23 U.S. gal/acre.
210 L/ha x 0.09 = 18.9 Imp. gal/acre.

Method 2

1. Set out two stakes 200 m (656 ft) apart in the field. Do not use a different distance. To do so will give the wrong value to use in the calculation because the factor used in the equation with this method is obtained by dividing the number of square metres in one hectare by the distance travelled as follows:
   $$\frac{10.000\ \text{m}^2}{200\ \text{m}} = 50^*$$
2. Add sufficient clean water to sprayer to conduct the following precalibration adjustments:
   Adjust the boom height to give the amount of overlap recommended by the sprayer manufacturer for the nozzle tips and nozzle spacing used. For example, for a spray angle of 65 the boom should be 53 to 58 cm above the surface to be sprayed, for 80 the height should be 42 to 48 cm.
   Operate the sprayer and adjust the by pass relief valve to give the desired pressure while the nozzles are operating. This will also ensure that the sprayer lines are full of water.
3. Fill the tank and record the water level on the sight gauge on the tank or with a measuring stick.
4. Spray between the stakes in one direction at a definite speed and pressure. Turn the boom "on" as the first stake is passed and turn the boom "off" as the second stake is passed. Mark the throttle setting.
5. Return the sprayer to the same level location as before the calibration run. Carefully measure the amount of water required to refill the tank to the same mark on the sight gauge or measuring stick.
6. Caluclate the application rate in litres per hectare using this formula:
   $$\text{L/ha} = \frac{\text{litres water added} \times 50^*}{\text{swath width in metres}}$$
   For overall spraying the swath width equals the number of nozzles x the nozzle spacing in metres.
   * *The factor is obtained by dividing the number of square metres in a hectare by the distance travelled.*

Sample Calculations:

Overall Spraying: If the sprayer has a 6.5 m swath width and 30 L of water are required to refill the tank, the application rate in litres per hectare is:

$$\frac{30 \times 50}{6.5} = 231 \text{ L/ha}$$

Band Spraying: If the sprayer has 10 nozzles and each nozzle covers a 36 cm (0.36 metre) band, the total width of the spray patterns (swath width) is:

10 x 0.36 or 3.6 metres

If 10 litres of water are required to refill the tank, the application rate in litres per hectare is:

$$\frac{10 \times 50}{3.6} = 139 \text{ L/ha}$$

CALIBRATION KITS

Sprayer calibration bottles and kits are available. For further information contact your local office of the Ontario Ministry of Agriculture and Food or manufacturers of sprayers, sprayer parts or herbicides.

When band spraying, the acreage sprayed is NOT the same as the crop acreage. The herbicide rates given in this publication are based on the area actually sprayed.

Determine the number of hectares per tankful.
After the sprayer is calibrated, the number of hectares that can be sprayed with a full tank can be determined by using the following:

$$\frac{\text{Tank capacity in litres}}{\text{litres per hectare}} = \text{hectares per tank}$$

Sample calculations:

$$\frac{\text{450 litre tank}}{\text{110 litres per hectare}} = \text{4.1 hectares per tank}$$

If the tank is marked in imperial gallons, convert to litres by using the following:
imperial gallons x 4.5 = litres
For example 80 imperial gallons x 4.5 = 360 litres

If marked in U.S. gallons, convert to litres by using the following:
U.S. gallon x 3.8 = litres
For example 100 U.S. gallons x 3.8 = 380 litres

DETERMINING THE AMOUNT OF HERBICIDES NEEDED

Determining amount of product per hectare:

Most rates suggested in this publication are given in terms of both active ingredients (common name) per hectare and product (TRADE NAME) per hectare. However, where the amount of active ingredient in the formulations available varies considerably (for example, 2,4-D is available in concentrations of 100 g/L, 400 g/L, 500 g/L, etc.) the rate is given in terms of active ingredient only. To convert any rate given in terms of active ingredient per hectare to a rate in terms of product per hectare **consult Table 1** for the factor to use and the example below of how to make the calculation. If the rate suggested is given in terms of product per hectare, simply use that amount. (Double check the label on the container before use for the amount of active ingredient contained.)

EXAMPLE ON THE CONVERSION FACTOR

Multiply recommendation of amount of active ingredient in text by the conversion factor to get the amount of product to use

Dry materials: To apply 1.1 kg/ha linuron to control annual weeds in carrots
LOROX DF (50% active) 1.1 x 2 = 2.2 kg/ha (product)

Liquid or flowable: To apply 1.5 kg/ha atrazine to control seedling weeds in corn.
AATREX (480 g/L active) 1.5 x 2.1 = 3.15 L/ha (product)

If 2,4-D like herbicides are involved, check Table 13 to see if the recommended rates will control a particular weed. Specific measures are required to handle weeds that do not respond to the routine program. These are outlined under the crop in question or in special sections.

NOTE: Throughout the Recommendations sections of this publication, the common name of each herbicide (its active ingredient) is printed in lowercase letters (examples: atrazine, dicamba, glyphosate), whereas the product TRADE NAME (the total liquid, or powder, etc., inside the container as supplied by the manufacturer) is printed in capital letters (example: AATREX, BANVEL, ROUNDUP), and its formulation is listed within brackets following the trade name.

Determining amount of product required per tankful:

After determining how much commercial product is needed per hectare, calibrating the sprayer and determing the number of hectares each tank will cover - determine the quantity of herbicide needed to add to the spray tank using the following formula:

Product required per tank = hectares covered by tank x product rate per hectare.

Sample calculations:

(a) product/tank = 4.1 ha 2.2 kg/ha
= 9.02 kg LOROX per tank

(b) product/tank = 4.1 ha x 3.15 L/ha
= 12.92 L AATREX per tank

Follow manufacturer's recommendations on mixing order and procedures.

MATERIALS, MIXING AND MIXTURES

Dry herbicide formulations include granules, soluble powders and wettable powders. **Granules** do not require any mixing, and are ready to apply as is. Many herbicides used for preemergence treatments are available as granular formulations. In nearly every case, the performance of the granular formulations is equivalent to that of the liquid. Satisfactory distribution may be obtained with the equipment available. **Soluble powders** can be dissolved in water. **Wettable powders** will not dissolve but will form a suspension which requires constant agitation.

Liquid herbicide formulations either mix in water to form a solution or may be oil based and form an emulsion which will require agitation. Emulsions have a milky appearance. **NOTE:** When using more than one herbicide in a single application, it is safer to first mix one with the quantity of water to be used before the second is added. This procedure reduces the possibility of the formulation of gums or precipitates which may clog nozzles and filters. The need to consult the package labels for information on the compatibility of different herbicide products must be emphasized since certain formulations may react when mixed together, resulting in materials with different properties and activities than the original ones. Where water is known to have an excessive salt content, compatibility of the water and the chemical at field strength should be tested first on a small scale. Also see section on Agitation in sprayer.

Mixtures of different herbicides or mixtures of herbicides with other pesticides or foliar fertilizers should NOT be applied in a single application unless registered for use in this way.

UNLESS specifically mentioned in this publication, or on a herbicide label, the addition of a surfactant or a detergent to a spray solution by the applicator is NOT recommended.

Application Indicators

Colorants - Foam Markers for Pesticides application - Colorants added to the pesticide solution will enhance the visibility of applied material. Foam marking systems assist the applicator in minimizing overlap. By adding a colorant to the basal sprays of herbivides on cut stumps of woody plants helps assure thorough coverage without respraying. Water soluble colorants can also be useful in lawn spraying. Examples of colorants are listed below.

Bullseye Basal 55	blue, oil soluble
Blazon	blue, water soluble
Bas-oil Red	red, oil soluble

ADDITIONAL INFORMATION

Video #39 Field Crop Sprayer Calibration.
#44 Nozzle Selection for Field Sprayers.
# 48 Circle Check your Sprayer

Available from: Independent Study, University of Guelph, Guelph, Ontario Canada N1G 2W1. Phone (519) 824-4120 ext. 3375.

FACTSHEETS

Order No.	Title
89-110	Flat fan nozzle tips for field weed sprayers
88-129	Field sprayer calibration
88-118	Reducing pesticide drift and crop damage
87-057	Pesticide container rinsing
87-044	Guide to handling and applying herbicide to protect water supplies and reduce personal exposure
86-077	Pesticide contamination of farm water supplies
89-108	Storing pesticides on the farm
88-083	Management of pesticides on the farm.

PUBLICATIONS

Order No.	Title
1849/E	Field Sprayers for Pesticides

Available from Agriculture Canada

BEANS (WHITE, SNAP and KIDNEY)

NOTE: All treatments should be applied in 150 to 300 L water per hectare unless otherwise specified.

Cultivation, rotation and other cultural practices are effective weed control techniques that should be considered along with herbicide treatments when developing a weed control program. Any single method of weed control or the continuous use of the same chemical can lead to the build up of weeds resistant or tolerant to that control method. Rotation to other crops and/or other control methods will reduce the chance of developing new or unique weed infestations.

High speed (10-20 km/hr) shallow (2.5 to 3 cm) cultivation with a rotary hoe when the beans are in the 1 to 2 leaf stage will help to control small weed seedlings. This technique will not reduce herbicide action and may in some years enhance chemical weed control and improve crop safety.

Inter-row cultivation may be required when weeds escape herbicide treatment; weeds should be considered as escapes when they are 5 to 7 cm high. Cultivation should be shallow to prevent exposure of untreated soil and germination of new weed seeds.

Band treatment of chemical over the row will reduce costs by one-half to two-thirds, depending on the row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials can be spread on tillage equipment. Where possible it is always a good idea to till fields with perennial weeds last. Custom operators should be particularly careful when moving from one farm to another. For additional information see OMAF Factsheet, Long-term Weed Control Planning, Agdex 641 and the section on **preventative weed control** in this publication.

Some chemicals may also be impregnated on dry bulk fertilizer. Check the label for recommended fertilizer ingredients. Registered rates for metobromuron differ between formulations. Rates and application techniques vary for trifluralin products. For further information on these and other chemicals refer to label recommendations and also the "Notes on Chemicals" section in this publication.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Emerged quackgrass and Canada Thistle	amitrole AMITROL-T (200 g/L)	3.400 to 4.400 kg/ha 17.00 to 22.00 L/ha	**Not registered for use on snap beans or kidney beans.**
Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	Apply in 100 to 300 L of water per hectare in the previous fall or in the spring before the crop is planted. A minimum of 2 seasons control is obtained at these rates.
	glyphosate* ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

- *Various glyphosate products are available. See Table 1.*

Preplant Incorporated			
Germinating annual grasses, nutsedge	EPTC EPTAM (800 g/L)	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha	If dry weather has preceded the application of EPTC, delay seeding 7 to 10 days. Temporary injury can occur in the emerging crop. Many annual broadleaf weeds may escape when EPTC is used alone. Use the high rate for nutsedge control.
Germinating annual grasses, nutsedge, annual nightshades	metolachlor DUAL (960 g/L)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha	Metolachlor must be preplant incorporated before seeding the crop. Perennial weeds other than nutsedge, are not controlled. Many annual broadleaf weeds may escape when metolachlor is used alone.
Germinating annual grasses, lamb'squarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.147 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.20 L/ha 1.50 to 2.75 L/ha	The use of chloramben, metobromuron or monolinuron preemergence or the postemergence application of bentazon will control additional broadleaf weeds.
Germinating annual grasses, lamb's-quarters and pigweed including triazine resistant species. Suppression of nightshade and lady's-thumb	ethalfluralin EDGE (50 DF)	0.700 to 1.100 kg/ha 1.40 to 2.20 kg/ha	The use of chloramben, metobromuron or monolinuron preemergence or the postemergence application of bentazon will control additional broadleaf weeds. See "Notes on Chemicals" section for mixing, agitation and incorporation techniques. Not registered for use on snap beans.
Preemergence			
Germinating common annual broadleaf weeds and grasses	chloramben AMIBEN (10 Gr)	2.250 kg/ha 22.50 kg/ha	FOR SNAP BEANS ONLY. Treat at planting time or shortly after but before weed seedlings appear. This treatment may be applied as an overall or band treatment. Chloramben controls most annual broadleaf weeds and grasses with the exception of mustards for at least 8 weeks after application.
Germinating common annual broadleaf weeds**	metobromuron PATORAN FL (400 g/L) PATORAN (50 WP)	1.125 to 1.375 kg/ha 2.81 to 3.44 L/ha 2.25 to 2.75 kg/ha	Do not exceed 1.17 kg/ha (active) for kidney beans or snap beans. Beans should be seeded at least 5 cm deep. Injury may occur if beans are under stress or from treated soil having been splashed up onto the leaves by a rainstorm. A shallow harrowing or rotary hoeing after application of the chemical will reduce the possibility of splash up as well as help activate the chemical if dry weather follows application. Cultivation may be required with the low rate. Label rates for Patoran Flowable range from 2.5 to 4.25 L/ha.
	monolinuron AFESIN (200 g/L)	1.100 to 1.400 kg/ha 5.50 to 7.00 L/ha	Beans should be seeded at least 5 cm deep. Shallow planted crops may be injured if heavy rains follow application. A shallow harrowing or rotary hoeing after application of the chemical will reduce the possibility of splash up as well as help activate the chemical if dry weather follows application.

** *Common annual broadleaf weeds include ragweed, pigweed, lamb's-quarters and mustards (see exceptions under remarks).*

Postemergence			
Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle and some suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	Use 100 to 400 L of water per hectare. For annual broadleaf weeds apply when beans are in unifoliate to 4th trifoliate leaf stage and weeds are small and actively growing. Many annual broadleaf weeds are controlled including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10

			leaf). Two applications of 1.75 L/ha (0.85 kg/ha) 10 days apart may be required to control the perennial weeds. Use the 2.25 L/ha (1.08 kg/ha) rate for annual broadleaf weeds.
Emerged quackgrass and emerged annual grasses	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Not registered for use on snap beans. Thorough preplant tillage will ensure more uniform quackgrass emergence. Follow with a cultivation 7 days after treatment in wide row crops. Apply in 110 to 200 L/ha of water. Use Merge at 1.0% volume/volume of water.
Annual grasses including volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant MERGE	0.147 to 0.295 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Use higher rate for volunteer spring cereals. Treat the 1 to 6 leaf stage of annual grass. Apply using 110 to 200 L/ha of water.
Green and yellow foxtail, barnyard grass, old witchgrass, wild oats, fall panicum and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	1.000 kg/ha 3.52 L/ha	Do not apply if rain is expected within one hour after application. Annual broadleaf weeds must be controlled with other herbicides.
Emerged annual grass and broadleaf weeds	fenoxaprop-ethyl EXCEL (90 g/L) plus bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.122 kg/ha 1.36 L/ha 0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	Not registered on snap beans. Mix EXCEL and BASAGRAN for the control of annual grass and broadleaf weeds. Add BASAGRAN followed by EXCEL followed by ASSIST oil to spray tank half full of clean water. Ensure that these instructions are followed for subsequent tank loads. Avoid excessive agitation in the spray tank. For more specific details regarding weeds controlled and spraying instructions refer to Notes on Chemicals section and respective product labels. Temporary crop injury may occur under abnormally hot, humid conditions. Reduce the oil concentrate to 1 litre per hectare when these conditions occur. If broadleaf and grass weeds are not in the correct leaf stage for a tank-mix application, use a split application at the correct stage for each product.
Green and yellow foxtail, barnyard grass, old witchgrass, fall panicum, proso millet and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.122 kg/ha 1.36 L/ha	Treat at the 1 to 6 leaf stage of annual grass. Not registered for snap beans.
Split Application			
Germinating annual broadleaf weeds and grasses, nutsedge	EPTC EPTAM (800 g/L) followed by metobromuron PATORAN FL (400 g/L) PATORAN (50 WP) or by monolinuron AFESIN (200 g/L) or by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha 1.125 to 1.375 kg/ha 2.80 to 3.44 L/ha 2.25 to 2.75 kg/ha 0.750 to 1.100 kg/ha 3.75 to 5.50 L/ha 0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on EPTC in preplant incorporated section. See remarks on metobromuron and monolinuron in the preemergence section.See remarks on bentazon in the postemergence section.

Germinating annual broadleaf weeds and grasses, nutsedge	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L) followed by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.600 to 1.140 kg/ha 1.10 to 2.09 L/ha 1.20 to 2.20 L/ha 1.50 to 2.85 L/ha 0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on trifluralin in the preplant incorporated section.See remarks on bentazon in the postemergence section.
Germinating annual broadleaf weeds and grasses	EPTC EPTAM (800 g/L) followed by chloramben AMIBEN (10 Gr)	2.000 to 3.000 kg/ha 2.50 to 3.75 L/ha 2.250 kg/ha 22.50 kg/ha	See remarks on EPTC in the preplant incorporated section and chloramben in the preemergence section.
	ethalfluralin EDGE (50 DF) followed by metobromuron PATORAN FL (400 g/L) PATORAN (50 WP) or by chloramben AMIBEN (10 Gr) or by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.700 to 1.100 kg/ha 1.40 to 2.20 kg/ha 1.125 to 1.375 kg/ha 2.80 to 3.44 L/ha 2.25 to 2.75 kg/ha 2.250 kg/ha 22.50 kg/ha 0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on ethalfluralin in the preplant incorporated section. See remarks on metobromuron and chloramben in the preemergence section. See remarks on bentazon in the postemergence section.
Germinating annual broadleaf weeds and grasses, nutsedge, annual nightshade	metolachlor DUAL (960 g/L) followed by metobromuron PATORAN FL (400 g/L) PATORAN (50 WP) or by monolinuron AFESIN (200 g/L) or by chloramben AMIBEN (10 Gr) or by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 1.125 to 1.375 kg/ha 2.80 to 3.44 L/ha 2.25 to 2.75 kg/ha 0.750 to 1.100 kg/ha 3.75 to 5.50 L/ha 2.250 kg/ha 22.50 kg/ha 0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on metolachlor in the preplant incorporated section.See remarks on metobromuron, chloramben and monolinuron in the preemergence section.See remarks on bentazon in the postemergence section.

Germinating annual broadleaf weeds and grasses	trifluralin	0.600 to 1.147 kg/ha	See remarks on trifluralin in the preplant incorporated section. See remarks on metobromuron, chloramben and monolinuron in the preemergence section.
	TREFLAN (545 g/L)	1.10 to 2.10 L/ha	
	RIVAL (500 g/L)	1.20 to 2.30 L/ha	
	TRIFLUREX 40 EC (400 g/L)	1.50 to 2.85 L/ha	
	followed by metobromuron	1.125 to 1.375 kg/ha	
	PATORAN FL (400 g/L)	2.80 to 3.44 L/ha	
	PATORAN (50 WP)	2.25 to 2.75 kg/ha	
	or by monolinuron	0.750 to 1.100 kg/ha	
	AFESIN (200 g/L)	3.75 to 5.50 L/ha	
	or by chloramben	2.250 kg/ha	
	AMIBEN (10 Gr)	22.50 kg/ha	
Germinating annual broadleaf weeds, annual grasses, quackgrass	metobromuron	1.125 to 1.375 kg/ha	See remarks on metobromuron, monolinuron and chloramben in the preemergence section.See remarks on sethoxydim for annual grass and quackgrass rates in the postemergence section.
	PATORAN FL (400 g/L)	2.80 to 3.44 L/ha	
	PATORAN (50 WP)	2.25 to 2.75 kg/ha	
	or monolinuron	0.750 to 1.100 kg/ha	
	AFESIN (200 g/L)	3.75 to 5.50 L/ha	
	or chloramben	2.250 kg/ha	
	AMIBEN (10 Gr)	22.50 kg/ha	
	followed by sethoxydim	0.147 to 0.497 kg/ha	
	POAST (184 g/L)	0.80 to 2.70 L/ha	
	plus surfactant		
	MERGE	1.000 to 2.000 L/ha	
	bentazon	1.082 kg/ha	See remarks on bentazon and sethoxydim in the postemergence section. Allow 4 days between application of sethoxydim and bentazon.
	BASAGRAN (480 g/L)	2.25 L/ha	
	plus ASSIST oil concentrate	2.000 L/ha	
	followed by sethoxydim	0.147 to 0.497 kg/ha	
	POAST (184 g/L)	0.80 to 2.70 L/ha	
	plus surfactant/solvent		
	MERGE	1.000 to 2.000 L/ha	

Harvest-Aid

Harvest-Aid to burn off weeds	diquat	0.420 to 0.550 kg/ha	Diquat should be used to burn off weeds at 0.42 kg (active) per hectare (2.1 L product) where the weed infestation is light to moderate, and at 0.55 kg (active) per hectare (2.75 L product) where weed infestation is moderate to heavy. Use 300 L/ha of water. Spray when 80 to 90% of the leaves have dropped from the bean plants. Add AGRAL 90 (a wetting and spreading agent) at a rate of 1 L/1000 L of spray mixture to provide a more uniform coverage. Weeds should be burned off in a week or less. **The treatment does not mature beans nor does it lower moisture** content of beans. Pulling and combining beans may be done at any time. Not **registered for use on snap beans.**The preferred treatment is ground application when aerial application is employed refer to notes on chemicals.
	REGLONE (200 g/L)	2.10 to 2.75 L/ha	
	plus surfactant		
	AGRAL 90		

Table 2. White, Snap Or Kidney Bean Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES								ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method[1] of Application	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
amitrole[4]	AMITROL-T	preplant or postharvest	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	G	E	G	G
glyphosate*	ROUNDUP	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	E	**	**	E
EPTC	EPTAM	ppi	F	F	G	P	F	F	F	F	E	E	E	E	E	F	P	F	P	G	F	P	P	E
metolachlor	DUAL	ppi	P	P	P	P	G	P	P	P	E	E	G	E	E	F	P	P	P	G	P	P	P	G
trifluralin	RIVAL or TREFLAN or TRIFLUREX	ppi	P	P	G	P	P	G	P	P	E	E	G	E	E	F	P	P	P	P	P	P	P	E
ethalfluralin	EDGE	ppi	E	F	G	P	F	G	P	P	E	E	E	E	E	G	F	P	P	P	P	P	P	E
chloramben	AMIBEN	pre	G	G	G	F	F	E	G	F	G	F	P	F	G	P	P	P	P	P	P	P	P	E
metobromuron	PATORAN	pre	E	E	E	E	G	E	G	F	F	F	F	F	G	P	P	P	P	P	P	P	P	G
monolinuron	AFESIN	pre	E	E	E	E	G	E	G	F	F	F		F	G	P	P	P	P	P	P	P	P	G
bentazon	BASAGRAN	post	F	E	G	E	G	F	G	E	P	P	P	P	P	P	F[3]	P	P	G[3]	P	F[3]	G[3]	G
diclofop-methyl	HOE-GRASS 284	post	P	P	P	P	P	P	P	P	E	E	E	E	E	P	P	P	P	P	P	P	P	E
sethoxydim[2]	POAST	post	P	P	P	P	P	P	P	P	E	E	E	E	E	E	P	P	P	P	G	P	P	E
fenoxaprop-ethyl[2]	EXCEL	post	P	P	P	P	P	P	P	P	E	E	E	E	E	E	P	P	P	P	P	P	P	E
fenoxaprop-ethyl[2] + bentazon	EXCEL + BASAGRAN	post	F	E	G	E	G	F	E	E	E	E	E	E	E	E	P	P	P	P	P	P	P	G

---

* *Various formulations available, see Table 1.*

** *Cannot be used effectively to control these weeds in the bean crop, but it may be used to control all weeds after harvest.*

[1] *ppi = preplant incorporated; pre = preemergence; post = postemergence.*

[2] *Sethoxydim (quackgrass rate 0.5 kg/ha) and fenoxaprop-ethyl are not registered for use on snap beans.*

[3] *Control of these perennial weeds may require two applications of BENTAZON + ASSIST OIL CONCENTRATE about 7 to 10 days apart.*

[4] *amitrole is not registered for use on snap or kidney beans.*

CANOLA (RAPESEED) - Spring Planted

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating annual grasses and good control of lamb's-quarters and pigweed, including triazine-resistant	trifluralin* TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.147 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.29 L/ha 1.50 to 2.75 L/ha	Soil incorporation is essential. See "Notes on Chemicals".
	ethalfluralin EDGE (50 DF)	0.700 to 1.100 kg/ha 1.40 to 2.20 kg/ha	Vigorous continuous agitation is essential for proper mixing. All in line screens should be 50 mesh or coarser. Soil incorporation is essential. See "Notes on Chemicals".

Postemergence

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Emerged annual grass weeds including wild oats	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.700 to 0.800 kg/ha 2.46 to 2.82 L/ha	Apply in the spring when the annual grasses are in the 1 to 4 leaf stage. The higher rate (2.82 L/ha) must be used to control wild oats in the 4 to 5 leaf stage. Do not use if rain is expected within 1 hour after application. Broadleaf herbicides must be applied at least 4 days before or after diclofop-methyl.
Emerged annual grasses, wild oats, volunteer corn, volunteer cereals (in the year of germination) and quackgrass.	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	Apply in the spring to annual grasses in the 2 to 5 leaf stage. Season long top growth suppression of quackgrass will be attained at the 1.0 L/ha rate. Apply up to the 5th leaf stage of crop growth or no later than 80 days prior to harvest. AGRAL 90 to be applied at 1 litre in 1000 litres of spray solution.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals.	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/ha 0.81 to 1.63 kg/ha 2.000 L/ha 1.000 L/ha	Canola is tolerant to sethoxydim at any stage of growth. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 - 200 L/ha water volume.
Emerged annual grasses and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.122 kg/ha 1.36 L/ha	Second flush annual grasses will not be controlled if emergence occurs after application. This treatment will not control volunteer winter wheat. Refer to "Notes on Chemicals".
Emerged barnyard grass, green foxtail, wild oats, volunteer wheat, barley and quackgrass.	quizalofop-ethyl ASSURE (96 g/L) plus oil concentrate CANPLUS 411	0.096 to 0.140 kg/ha 1.00 to 1.46 L/ha	Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2 to 6 leaf stage of growth. Use the higher rate for control of quackgrass. Use the higher rate of Canplus 411 when wild oats and quackgrass are the target weeds or under drought conditions. Do not apply to canola within 64 days of harvest. Add CANPLUS 411 at 5 to 10 litres per 1000 litres of spray solution.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1-3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Use MERGE at a rate of 1% v/v. Quackgrass control will be provided for 6-8 weeks.

	sethoxydim POAST (184 g/L) plus ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus ASSIST oil concentrate	0.500 kg/ha 2.72 L/ha 2.000 kg/ha 4.08 L/ha 2.000 L/ha	See above remarks.

* *Trifluralin, fenoxaprop-ethyl, fluazifop-butyl, diclofop-methyl and sethoxydim are registered for use on spring planted canola only. No herbicides are currently registered for use on winter rapeseed.*

Harvest Aid

Harvest Aid and to burn off weeds	diquat REGLONE (200 g/L) plus surfactant AGRAL 90	0.300 to 0.550 kg/ha 1.50 to 2.75 L/ha	Apply by air in at least 20 L of water/ha when crop is 60-75% seed turn (green or brown) stage. This application will burn off weeds, and reduce the incidence of pod shattering and eliminate the need for swathing. Commence combining not later than 14 days after application. For Argentine varieties, Reglone should only be used to facilitate the harvest of a lodged crop. May be used on seed or commercial crops. Beware of drift to adjacent crops or plants.Apply AGRAL 90 at a rate of 1 litre of 1000 litres of spray solution.

Post Harvest

Quackgrass	glyphosate ROUNDUP (356 g/L)	0.900 kg/ha 2.53 L/ha	For a minimum of one season control of quackgrass, apply in the fall, after canola has been harvested, to actively growing quackgrass with 4 or more leaves per shoot. Apply using a flat-fan nozzle in 50 to 100 L of water per hectare. For use in higher water volumes, the addition of a surfactant (Enhance or Frigate) is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate and appropriate water volumes.

CANOLA (RAPESEED) TRIAZINE TOLERANT

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant Incorporated			
Germinating annual grasses and broadleaf weeds including some triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) plus metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG)	0.600 to 1.147 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.29 L/ha 0.280 to 0.425 kg/ha 0.56 to 0.85 L/ha 0.37 to 0.56 kg/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. Poor growing conditions can contribute to some crop injury which is usually temporary. Note label for information regarding proper rate for specific soil types.

Preemergence			
Wild mustard, triazine susceptible lamb's-quarters and other broadleaf weeds	atrazine ATRAZINE 500 (500 g/L) ATRAZINE 90W (90 WP)	1.000 to 1.500 kg/ha 2.00 to 3.00 l/ha 1.11 to 1.67 kg/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed.
Germinating annual broadleaf weeds	metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG)	0.280 to 0.425 kg/ha 0.56 to 0.85 L/ha 0.37 to 0.57 kg/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. Poor growing conditions can contribute to some crop injury which is usually temporary.
Postemergence			
Wild mustard, triazine susceptible lamb's-quarters and other broadleaf weeds	atrazine ATRAZINE 500 (500 g/L) ATRAZINE 90W (90 WP) plus oil	0.750 kg/ha 1.50 L/ha 0.83 kg/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. Apply at the 2 leaf stage of the crop. Use 17 L/ha or an emulsifiable light mineral oil and 150-400 L of water per hectare.
Wild mustard, stinkweed and other annual broadleaf weeds	cyanazine BLADEX LIQUID (480 g/L)	1.440 kg/ha 3.00 L/ha	The treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. Apply when the crop and weeds are in the 1 to 4 leaf stage. Optimum weed control is achieved when weeds are small and actively growing.
Annual broadleaf weeds including wild mustard and stinkweed. Emerged annual grasses, proso millet, wild oats, volunteer corn and volunteer cereals	cyanazine BLADEX LIQUID (480 g/L) plus sethoxydim POAST (184 g/L) plus ASSIST oil concentrate	1.440 kg/ha 3.00 L/ha 0.147 to 0.300 kg/ha 0.80 to 1.63 L/ha 2.000 L/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. See additional notes on cyanazine and sethoxydim.
Annual broadleaf weeds, including wild mustard and stinkweed, emerged annual grasses, seedling volunteer cereals and corn, and quackgrass	cyanazine BLADEX LIQUID (480 g/L) plus fluazifop-butyl FUSILADE (250 g/L)	1.440 kg/ha 3.00 L/ha 0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	This treatment is for use on triazine tolerant canola. Non triazine tolerant canola will be killed. See additional notes on cyanazine and fluazifop-butyl. This tank mix does not require Agral 90 to be included. Season long top growth suppression of quackgrass will be attained at the 1.0 L/ha rate.
Many annual broadleaf weeds	metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG)	0.275 to 0.350 kg/ha 0.55 to 0.70 L/ha 0.37 to 0.47 kg/ha	This treatment is for use only on triazine tolerant canola. Non triazine tolerant canola will be killed. Poor growing conditions can contribute to some crop injury which is usually temporary.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.140 to 0.300 kg/ha 0.76 to 1.63 L/ha 2.000 L/ha 1.000 L/ha	Triazine tolerant canola is tolerant to sethoxydim at any stage of growth. Complete control is normally obtained 7 to 21 days after application.
Emerged annual grasses and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.122 kg/ha 1.36 L/ha	Second flush annual grasses will not be controlled if emergence occurs after application. This treatment **will not** control volunteer winter wheat. See "Notes on Chemicals".

Emerged annual grasses, wild oats, volunteer corn, volunteer cereals (in the year of germination) and quackgrass	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	Apply in the spring to annual grasses in the 2 to 5 leaf stage. Season long top growth suppression of quackgrass will be attained at the 1.0 L/ha rate. Apply up to the 5th leaf stage of crop growth or no later than 80 days prior to harvest.Agral 90 to be applied at 1 litre to 1000 litres of spray solution.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will result in more uniform quackgrass emergence. Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L water per hectare. Use MERGE at a rate of 1% v/v. Quackgrass control will be provided for 6-8 weeks.
Quackgrass and annual grasses	sethoxydim POAST (184 g/L) ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus ASSIST oil concentrate	0.500 kg/ha 2.72 L/ha 2.000 kg/ha 4.08 L/ha 2.000 L/ha	See remark above.
Emerged barnyard grass, green foxtail, wild oats, volunteer wheat, barley and quackgrass.	quizalofop-ethyl ASSURE (96 g/L) plus oil concentrate plus Canplus 411	0.096 to 0.140 kg/ha 1.00 to 1.46 L/ha	Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2 to 6 leaf stage of growth. Use the higher rate for control of quackgrass. Use the higher rate of Canplus 411 when wild oats and quackgrass are the target weeds or under drought conditions. Do not apply to canola within 64 days of harvest. Add Canplus 411 at 5 to 10 litres per 1000 litres of spray solution.

CORN, FIELD AND SWEET

Weed control in corn has become increasingly reliant upon chemicals. Although chemicals by themselves can be effective, cultivation, crop rotation and other cultural practices should not be forgotten. Any single method of weed control or the continuous use of the same chemicals can lead to the build up of weeds resistant or tolerant to that control method. Triazine-resistant lamb's-quarters and pigweed have become a problem as a result of continuous corn and the repeated use of triazine herbicides. Rotation to other crops and/or other control methods will reduce the chance of new or unique weed infestations.

Blind harrowing with a set of light harrows operating at a shallow depth before the corn has emerged, or using a weeder harrow (with L shaped flexible tines) when the crop is 5-10 cm high can also help control small annual weed seedlings. High speed (10 kph), shallow (2.5 to 3cm) cultivation with the rotary hoe when corn is 7 to 8 cm in height will help to control small weed seedlings. These techniques will not reduce herbicide action and may in some years enhance chemical weed control. Inter-row cultivation can be used to complement other weed control measures. Row cultivation is most effective when weeds are small. Cultivation should be shallow to reduce the germination of new weed seeds, to reduce moisture loss and to reduce corn root injury. Inter-row cultivation may be required when weeds escape herbicide treatment; weeds should be considered as escapes when they are 5 to 7 cm high.

Band treatment of chemical over the row will reduce cost by one-half to two-thirds, depending on the row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials (i.e. nutsedge) can be spread on tillage equipment. Where possible it is always a good idea to till fields with perennial weeds last. Custom operators should be particularly careful when moving from one farm to another. For additional information, see OMAF Factsheet, Long-term Weed Control Planning, Agdex 641.

Sweet Corn Recommendations very closely parallel the recommendations for field corn. There are three differences that need to be noted: (1) the sensitivity of some sweet corn hybrids to 2,4-D; (2) no general recommendations for using preemergence linuron due to injury on some sweet corn hybrids. Where 2,4-D is being used beware of 2,4-D drift hazard (see precautions in postemergence with 2,4-D section); and, (3) dicamba is not recommended for use on sweet corn because of crop injury.

Sweet corn most frequently is grown in areas where the crops in sequence are very sensitive to atrazine residues. Avoid using atrazine rates above 1.1. kg (active) per hectare **(2.2 L of 500 g/L) or 1.2 kg of (90 WG) PRODUCT)**. (See notes on atrazine residues for suggestions).

Seed Corn Recommendations: Although most field corn recommendations are applicable to seed corn, there are inbreds which are susceptible to some chemicals. Check with the contracting company before applying any herbicide.

For information on specific weeds see Table 3A to 3D and then refer to the appropriate section for details about herbicide treatment.

NITROGEN solution can be used as a carrier, instead of water, for preplant and preemergence application of some herbicides. Weed control activity is not increased. Spraying should be done before crop emergence. Consult the herbicide label as to the proper methods of application and use of dispering agents. Calibrate the sprayer to apply the required amount of NITROGEN. Stainless steel flood jet nozzles of adequate size (e.g. Teejet TK SS 5 to TK SS 10) should be used. The NITROGEN solution is mildly corrosive, especially to brass, and the sprayer should be cleaned immediately after use. UNITE may be used as an aid in improving liquid fertilizer herbicide compatibility and stability when a simultaneous application of a liquid fertilizer and liquid or wettable powder herbicide is desired. Because formulations and rates vary, it is essential to read the label to determine the exact amount and method to be used. DO NOT apply with postemergence herbicides.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant or Post Harvest			
Quackgrass	amitrole AMITROL-T (200 g/L)	3.400 to 4.400 kg/ha 17.00 to 22.00 L/ha	Apply to actively growing quackgrass (15-20 cm high) in the fall or spring. Plow or thoroughly disk 10-14 days after application. Cultivation may be required when the corn is 12 to 15 cm.
	glyphosate** ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	Apply in 100 to 300 L of water per hectare in the previous fall or in the spring before the crop is planted. Other herbicides are necessary for annual weed control in the crop. A minimum of 2 seasons control is obtained at these rates.
	glyphosate** ROUNDUP (356 g/L)	0.888 kg/ha 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of surfactants such as Enhance or Frigate, is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

** *Additional glyphosate products are available. See Table 1.*

Table 3A Corn Herbicide Weed Control Ratings (Preplant Or Post Harvest Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent F - Fair
G - Good P - Poor

			ANNUAL BROADLEAVES										ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method of Application	buckwheat, wild	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
amitrole	AMITROL-T	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	G	**	**	E
glyphosate	ROUNDUP*	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	P	E	**	E	**	**	E
glyphosate	ROUNDUP*	spot treat or after harvest	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	E	P	E	F	E	E	E	P

* *Various formulations available, see Table 1.*

** *Indicates the annual weeds will be controlled if emerged, and the perennials can be controlled if treated at the optimum time which is usally not the same time as for quackgrass.*

Preplant Incorporated

NOTE: Unless specified, apply all treatments in 150 to 300 L of water per hectare. Two incorporations at right angles using a double disk or vibrating shank cultivator (S-tine type) are recommended. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating with incorporation the fields with perennial weeds last.

Germinating annual grasses	butylate/ R25788 (butylate+)[1] SUTAN+ (800 g/L)	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha	Use lower rate for light weed infestation or on coarse-textured soils. Butylate$^+$ must be applied to a dry soil surface, incorporation may be delayed up to 4 hours.
	EPTC/ R25788 (EPTC+)[1] ERADICANE (800 g/L)	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha	See "Notes on Chemicals".

Nutsedge*, germinating annual broadleaf and grass weeds, including crabgrass, fall panicum and proso millet	butylate/ R25788 (butylate^{+})[1] SUTAN^{+} (800 g/L) either plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG) or plus cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG) or butylate/ atrazine (4:1) SUTAZINE^{+} ((4:1) 720 g/L)	3.400 to 6.800 kg/ha 4.25 to 8.50 L/ha 1.000 to 1.500 kg/ha 2.00 to 3.00 L/ha 1.11 to 1.67 kg/ha 1.802 to 2.644 kg/ha 3.75 to 5.50 L/ha 2.00 to 3.00 kg/ha 4.300 to 7.482 kg/ha 5.98 to 10.40 L/ha	Use lower rates for light weed infestations or on sand or loam soils. For annual grass control use butylate^{+} rate range of 3.4 to 4.4 kg/ha. For nutsedge or fall panicum use the higher rate range of 4.4 to 6.8 kg/ha. Any late emerging nutsedge will not likely reduce yields. For velvetleaf control use the higher rates of butylate^{+} plus atrazine. To improve overall weed control, atrazine or cyanazine should be used as a tank mix. Use the low rate of cyanazine on coarse textured soils, particularly for sweet corn. Mid season to late season germinating fall panicum may not be controlled by butylate^{+}.
	EPTC/ R25788 (EPTC^{+})[1] ERADICANE (800 g/L) plus atrazine** ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	3.400 to 6.800 kg/ha 4.25 to 8.50 L/ha 1.200 to 1.500 kg/ha 2.40 to 3.00 L/ha 1.33 to 1.67 kg/ha	See above and "Notes on Chemicals" for information on EPTC^{+}. For suppression of moderate to heavy infestations of wild proso millet, use the higher rate of EPTC^{+} with atrazine. For most effective suppression of proso millet delay treatment and planting until mid to late May. Cultivation or a directed post application of linuron may be required to control later emerging proso millet.
	metolachlor DUAL (960 g/L) plus atrazine** ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG) or metolachlor/ atrazine PRIMEXTRA ((3:2) 500 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 1.000 to 1.500 kg/ha 2.00 to 3.00 L/ha 1.11 to 1.67 kg/ha 3.250 to 4.250 kg/ha 6.50 to 8.50 L/ha	Metolachlor controls the grasses and atrazine controls the broadleaf weeds. When incorporated, metolachlor will control nutsedge for most of the season (10-14 weeks): mid season (July) germinating fall panicum may not be controlled. The high rate should be used where annual grass build up or nutsedge infestation is evident.
	EPTC/ R25788 (EPTC^{+})[1] ERADICANE (800 g/L) plus cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG)	6.800 kg/ha 8.50 L/ha 2.043 to 2.404 kg/ha 4.25 to 5.00 L/ha 2.27 to 2.67 kg/ha	See above and "Notes on Chemicals" for information on EPTC^{+} and cyanazine. For increased control of proso millet, an inter-row cultivation should be used.
	metolachlor DUAL (960 g/L) plus cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG)	1.923 to 2.644 kg/ha 0.96 to 2.75 L/ha 1.803 to 2.703 kg/ha 3.75 to 5.62 L/ha 2.00 to 3.05 kg/ha	Metolachlor controls the grasses and cyanazine controls the broadleaf weeds. Use the high rates of cyanazine for heavy weed infestations or on fine textured soils. This treatment will give fair control of proso millet. See above treatment for additional notes. See comments at beginning about mixing with fertilizers.
Nutsedge*, germinating annual grasses including crabgrass and fall panicum	metolachlor DUAL (960 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha	Metolachlor controls mainly grasses. See above for additional notes.
Germinating annual broadleaf weeds and grass. Crabgrass and fall panicum may escape	atrazine/ simazine (1:1) EKKO (80 WP)	3.400 kg/ha 4.25 kg/ha	Full season annual weed control can be expected except for crabgrass or fall panicum where infestations have built up. Simazine is more persistent than atrazine, thus residues may be high and only corn should be planted the following year.

	simazine PRINCEP NINE-T (90 WG)	1.350 to 2.250 kg/ha 1.50 to 2.50 kg/ha	See comments for atrazine/simazine above.
	cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG) plus atrazine** ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	2.115 to 2.644 kg/ha 4.40 to 5.50 L/ha 2.35 to 3.00 kg/ha 1.125 to 1.300 kg/ha 2.25 to 2.60 L/ha 1.25 to 1.44 kg/ha	This combination will improve barnyard grass and pigweed control over cyanazine alone. Use the lower rate of both cyanazine and atrazine on coarse textured soils and the higher rates on medium to fine textured soils. Do not use on muck or peat soils. Mid season (July) germinating fall panicum may not be controlled.
Velvetleaf, other germinating annual broadleaf and grass weeds	metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG) plus atrazine ATRAZINE 500 (500 g/L) ATRAZINE 90W (90 WP) plus metolachlor DUAL (960 g/L) or plus metolachlor/ atrazine (3:2) PRIMEXTRA ((3:2) 500 g/L)	0.300 to 0.500 kg/ha 0.60 to 1.00 L/ha 0.40 to 0.67 kg/ha 1.100 kg/ha 2.20 L/ha 1.22 kg/ha 1.683 kg/ha 1.75 L/ha 2.800 kg/ha 5.60 L/ha	Use the high rate of metribuzin if heavy velvetleaf pressure is expected. Apply as a broadcast treatment and shallow incorporate thoroughly into the top 5 cm of soil prior to planting. Seed should be planted at least 4 cm deep. Use only on medium or heavy soils. Heavy rainfall and adverse growing conditions may result in temporary crop injury. **See SENCOR label for a list of corn hybrids previously tested for metribuzin tolerance.**

* *Nutsedge is impossible to eradicate in a single season, because of dormant underground tubers. One season control can be obtained and competition eliminated by using butylate$^+$, EPTC$^+$, or metolachlor. Such methods should be used every year where nutsedge is a serious problem (see notes on atrazine residues).*

** *Additional formulations are available. Use rates that give comparable amounts of active ingredient. (See Table 1).*

1 *An antidote (safening agent) has been added to both butylate$^+$ and EPTC$^+$ to prevent corn injury.*

Table 3B. Corn Herbicide Weed Control Ratings (Preplant Incorporated Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method of Application	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
atrazine/simazine	EKKO	preplant incorporated	E	F	E	E	E	E	E	E	E	P	F	E	E	F	E	E	P	P	P	P	F	F	P	P	E
butylate$^+$	SUTAN$^+$	preplant incorporated	P	P	G	P	F	P	G	F	F	P	P	E	E	G	E	E	F	P	P	P	G	P	P	P	E
butylate$^+$ + atrazine or butylate$^+$/atrazine	SUTAN$^+$ + atrazine or SUTAZINE$^+$	preplant incorporated	E	F	E	E	E	E	E	G	G	P	G	E	E	G	E	E	F	P	P	P	G	F	P	P	E

Table 3B. Corn Herbicide Weed Control Ratings (Preplant Incorporated Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method of Application	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
butylate⁺ + cyanazine	SUTAN⁺ + BLADEX	preplant incorporated		F			E	E	E	F	E	P	F	E	E	G	E	E	F	P	P	P	G	P	P	P	E
cyanazine + atrazine	BLADEX + atrazine	preplant incorporated	E	F	E	E	E	E	E	E	E	P	F	G	E	G	E	E	P	P	P	P	P	P	P	P	E
EPTC⁺	ERADICANE	preplant incorporated	P	P	G	F	G	P	G	F	F	F	P	E	E	G	E	E	F	P	F	P	G	P	P	P	E
EPTC⁺ + atrazine	ERADICANE + atrazine	preplant incorporated	E	F	E	E	E	E	E	E	E	F	G	E	E	G	E	E	F	P	F	P	G	F	P	P	E
EPTC⁺ + cyanazine	ERADICANE + BLADEX	preplant incorporated	E	F	E	E	E	E	E	E	E	F	G	E	E	G	E	E	G	P	F	P	G	F	P	P	E
metolachlor	DUAL	preplant incorporated	P	P	P	P	P	P	G	P	P	P	P	E	E	G	E	E	P	P	P	P	G	P	P	P	E
metolachlor + or/ atrazine	DUAL + atrazine or PRIMEXTRA	preplant incorporated	E	F	E	E	E	E	E	E	E	P	F	E	E	G	E	E	P	P	P	P	G	P	P	P	E
metolachlor + cyanazine	DUAL + BLADEX	preplant incorporated	E	F		E	E	E	E	G	E	P	F	E	E	G	E	E	P	P	P	P	G	P	P	P	E
metribuzin plus atrazine + metolachlor or metolachlor/atrazine	SENCOR plus ATRAZINE + DUAL or PRIMEXTRA	preplant incorporated	E	G	E	E	E	E	E	E	E	P	E	E	E	G	E	E	P	P	P	P	F	P	P	P	G
simazine	PRINCEP NINE-T	preplant incorporated	E	F	E	E	E	E	E	E	E	P	F	E	G	F	E	E	P	P	P	P	F	F	P	P	E

Preemergence

NOTE: Apply all treatments in 150 to 300 L water per hectare except where otherwise noted.

Germinating annual weeds including crabgrass, fall panicum and triazine resistant broadleaf weeds	metolachlor DUAL (960 g/L) plus dicamba BANVEL 480 (480 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.600 kg/ha 1.25 L/ha	DO NOT use this tank mix on sand or sandy soil or on sweet corn. High rates should be used on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds.

	metolachlor DUAL (960 g/L) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG) plus dicamba BANVEL 480 (480 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 1.000 to 1.500 kg/ha 2.00 to 3.00 L/ha 1.11 to 1.67 kg/ha 0.600 kg/ha 1.25 L/ha	See comments for metolachlor plus dicamba above.
	metolachlor DUAL (960 g/L) plus dicamba/ atrazine MARKSMAN ((1:2) 388 g/L)	1.923 to 2.644 kg/ha 2.00 to 2.75 L/ha 1.430 to 1.744 kg/ha 3.69 to 4.50 L/ha	See comments for metolachlor plus dicamba above.
	metolachlor DUAL (960 g/L) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG) plus linuron AFOLAN F (480 g/L) LOROX DF (50 DF)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 1.100 to 1.500 kg/ha 2.20 to 3.00 L/ha 1.22 to 1.67 kg/ha 0.380 to 0.750 kg/ha 0.79 to 1.56 L/ha 0.76 to 1.50 kg/ha	This tank mix can be used on light textured soils with OM greater than 1.0%. DO NOT use on sweet corn. Linuron controls triazine resistant lamb's-quarters and redroot pigweed. Fall panicum or velvetleaf may not be controlled for the full season.
	metolachlor/ atrazine (3:2) PRIMEXTRA ((3:2) 500 g/L) plus dicamba BANVEL 480 (480 g/L)	3.250 to 4.250 kg/ha 6.50 to 8.50 L/ha 0.600 kg/ha 1.25 L/ha	See comments for metolachlor plus dicamba above.
	metolachlor/ atrazine (3:2) PRIMEXTRA ((3:2) 500 g/L) plus linuron AFOLAN F (480 g/L) LOROX DF (50 DF)	3.250 to 4.250 kg/ha 6.50 to 8.50 L/ha 0.375 to 0.750 kg/ha 0.78 to 1.56 L/ha 0.76 to 1.50 kg/ha	See comments for metolachlor plus atrazine plus linuron above.
Germinating annual grasses including fall panicum and crabgrass	metolachlor DUAL (960 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha	Apply along with atrazine, atrazine + linuron, cyanazine or dicamba for broadleaf control. Fall panicum may not be controlled all season.
Germinating annual weeds including crabgrass and fall panicum	cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG)	2.250 to 3.250 kg/ha 4.68 to 6.76 L/ha 2.50 to 3.61 kg/ha	Barnyard grass and redroot pigweed may escape. Use the low rate on coarse textured soils and on sweet corn. Cyanazine is not recommended alone for fine textured or muck soils. See other treatments for appropriate tank mixes.
	cyanazine BLADEX LIQUID (480 g/L) BLADEX NINE-T (90 WG) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	1.803 to 2.284 kg/ha 3.75 to 4.75 L/ha 2.00 to 2.54 kg/ha 1.200 to 1.500 kg/ha 2.40 to 3.00 L/ha 1.33 to 1.67 kg/ha	The tank mix of cyanazine plus atrazine will improve control on fine textured soils and control of barnyard grass and redroot pigweed. DO NOT use the mixture on muck or peat soils. Fall panicum or velvetleaf may not be controlled for the full season.

	metolachlor	1.920 to 2.640 kg/ha	High rates should be used for heavy grass infestation areas and for fall panicum control. Fall panicum or velvetleaf may not be controlled for the full season.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	plus atrazine*	1.000 to 1.500 kg/ha	
	ATRAZINE 500 (500 g/L)	2.00 to 3.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 to 1.67 kg/ha	
	or metolachlor/ atrazine (3:2)	3.250 to 4.250 kg/ha	
	PRIMEXTRA ((3:2) 500 g/L)	6.50 to 8.50 L/ha	
	metolachlor	1.920 to 2.640 kg/ha	The tank mix of metolachlor plus cyanazine will control annual grass and broadleaf weeds. Fall panicum may not be controlled for the full season. High rates should be used for heavy grass infestation areas and for fall panicum control, or on fine textured soils.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	plus cyanazine	1.802 to 2.283 kg/ha	
	BLADEX LIQUID (480 g/L)	3.75 to 4.75 L/ha	
	BLADEX NINE-T (90 WG)	2.00 to 2.53 kg/ha	
Germinating annual broadleaf weeds	atrazine*	1.000 to 1.500 kg/ha	Weeds will normally emerge and die within a few days; atrazine can persist for varying lengths of time; longer under dry, cool weather and coarse textured soils. See tank mixes for reducing rates and avoiding residues, and for treatments to provide annual grass control.
	ATRAZINE 500 (500 g/L)	2.00 to 3.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 to 1.67 kg/ha	
	atrazine*	1.000 to 1.500 kg/ha	This treatment should provide good control of triazine resistant broadleaf weeds and velvetleaf. See notes on atrazine above with respect to residues. DO NOT apply to sand or sandy loam soils or to sweet corn.
	ATRAZINE 500 (500 g/L)	2.00 to 3.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 to 1.67 kg/ha	
	plus dicamba	0.600 kg/ha	
	BANVEL 480 (480 g/L)	1.25 L/ha	
	atrazine/ simazine (1:1)	3.400 kg/ha	Gives full season annual weed control except for heavy infestations of crabgrass and fall panicum. Soil residues may be high and only corn should be planted the following year.
	EKKO (80 WP)	4.25 kg/ha	
	simazine	1.350 to 2.250 kg/ha	See comments for atrazine/simazine.
	PRINCEP NINE-T (90 WG)	1.50 to 2.50 kg/ha	
Germinating annual broadleaf weeds and some grasses. Fall panicum may escape.	cyanazine	2.284 to 3.365 kg/ha	Barnyard grass may not be adequately controlled. Use higher rates on fine soils and heavy weed infestations. DO NOT incorporate this tank mix or use on sand or sandy loam soils or on sweet corn. Cyanazine and dicamba are short lived and will disappear before the end of the season. Dicamba controls velvetleaf, and triazine (atrazine, cyanazine or simazine) resistant broadleaf weeds. See below for additional notes on cyanazine.
	BLADEX LIQUID (480 g/L)	4.75 to 7.00 L/ha	
	BLADEX NINE-T (90 WG)	2.54 to 3.74 kg/ha	
	plus dicamba	0.600 kg/ha	
	BANVEL 480 (480 g/L)	1.25 L/ha	
	cyanazine	2.284 kg/ha	Treatment provides effective control of annual broadleaf and grass weeds including triazine resistant broadleaves. The addition of atrazine will improve control on fine textured soils and control of barnyard grass and redroot pigweed. DO NOT use on sweet corn. Do not use on sand or sandy loam soils.
	BLADEX LIQUID (480 g/L)	4.75 L/ha	
	BLADEX NINE-T (90 WG)	2.50 kg/ha	
	p[illegible]trazine	1.082 kg/ha	
	A[illegible]TREX (480 g/L)	2.25 L/ha	
	AATREX NINE-O (90 WG)	1.20 kg/ha	
	plus dicamba	0.600 kg/ha	
	BANVEL 480 (480 g/L)	1.25 L/ha	
	linuron	1.803 to 2.260 kg/ha	Annual grasses, ragweed and velvetleaf are partially controlled but are the first to escape, particularly if low rates of the herbicide are used. Do not use on sandy soils.
	AFOLAN F (480 g/L)	3.75 to 4.70 L/ha	

			Do not spray on emerged crops. Seed corn at least 4 cm deep. Heavy rainfall and adverse weather conditions may result in temporary crop injury.
	linuron LOROX L (480 g/L) LOROX DF (50 DF) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	1.082 kg/ha 2.25 L/ha 2.20 kg/ha 1.100 kg/ha 2.20 L/ha 1.22 kg/ha	Use this tank mix only on clay or clay loam soil to avoid injury. See notes on sweet corn. This tank mix controls annual weeds including triazine resistant redroot pigweed and lamb's-quarters and is a method of reducing atrazine residues. Annual grasses will be the first weeds to escape.
Velvetleaf, other germinating annual broadleaf and grass weeds	metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG) plus atrazine* ATRAZINE 500 (500 g/L) ATRAZINE 90W (90 WP) plus metolachlor DUAL (960 g/L) or plus metolachlor/ atrazine (3:2) PRIMEXTRA ((3:2) 500 g/L)	0.300 to 0.500 kg/ha 0.60 to 1.00 L/ha 0.40 to 0.67 kg/ha 1.100 kg/ha 2.20 L/ha 1.22 kg/ha 1.680 kg/ha 1.75 L/ha 2.800 kg/ha 5.60 L/ha	Use the high rate of metribuzin if heavy velvetleaf pressure is expected. Use only on medium or heavy soils. Heavy rainfall and adverse growing conditions may result in temporary crop injury. **See SENCOR label for a list of corn hybrids previously tested for metribuzin tolerance.**

* *Additional formulations are available. Use rates that give comparable amounts of active ingredient. See Table 1.*

STAGES OF CORN LEAF DEVELOPMENT

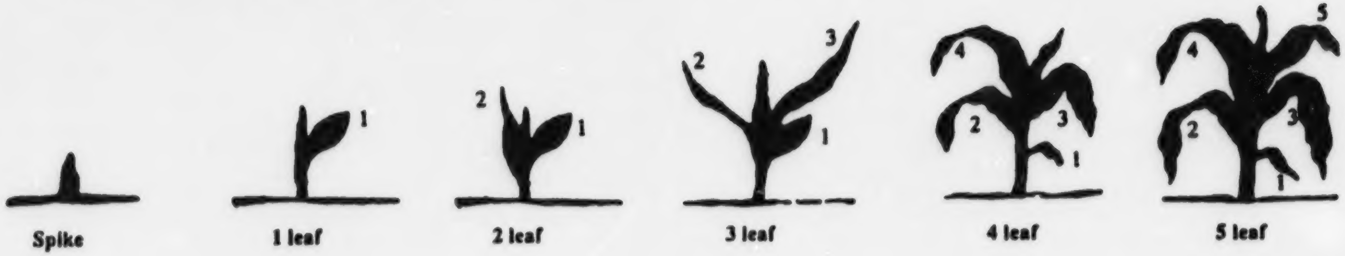


Table 3C. Corn Herbicide Weed Control Ratings (Preemergence Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent G - Good F - Fair P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
atrazine	atrazine*	preemergence	E	F	E	E	E	E	E	E	E	P	F	F	P	P	F	F	P	P	P	P	P	P	P	P	E
atrazine + dicamba	atrazine* + BANVEL	preemergence	E	G	E	E	E	E	E	E	E	E	G	F	P	P	F	F	P	P	P	P	P	P	P	P	E
atrazine/simazine	EKKO	preemergence	E	F	E	E	E	E	E	E	E	P	F	E	F	F	E	E	P	P	P	P	F	F	P	P	E
cyanazine	BLADEX	preemergence	G	F		G	E	E	E	F	E	P	F	F	E	G	E	E	P	P	P	P	P	P	P	P	E
cyanazine + atrazine	BLADEX + atrazine*	preemergence	E	F	E	E	E	E	E	E	E	P	F	G	E	G	E	E	P	P	P	P	P	P	P	P	E
cyanazine + dicamba	BLADEX + BANVEL	preemergence	G	G	E	E	E	E	E	E	E	E	G	F	E	G	E	E	P	P	P	P	P	P	P	P	E
cyanazine + atrazine + dicamba	BLADEX + AATREX + BANVEL	preemergence	E	G	E	E	E	E	E	E	E	E	G	G	E	G	E	E	P	P	P	P	P	P	P	P	E
linuron	AFOLAN F	preemergence	E	P		E	E	E	G	E	G	E	P	F	F	F	F	F	P	P	P	P	P	P	P	P	G
linuron + atrazine	LOROX + atrazine*	preemergence	E	F		E	E	E	G	E	E	E	F	F	F	F	F	F	P	P	P	P	P	P	P	P	G
metolachlor	DUAL	preemergence	P	P	P	P	P	P	G	P	P	P	P	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolachlor + or/ atrazine	DUAL + atrazine* or PRIMEXTRA	preemergence	E	F	E	E	E	E	E	E	E	P	F	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolachlor + cyanazine	DUAL + BLADEX	preemergence	E	F		E	E	E	E	G	E	P	F	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolachlor + dicamba	DUAL + BANVEL	preemergence	G	G	G	E	E	G	E	E	E	E	G	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolachlor + or/ atrazine + dicamba	DUAL + atrazine* or PRIMEXTRA + BANVEL	preemergence	E	G	E	E	E	E	E	E	E	E	G	E	E	G	E	E	P	P	P	P	P	P	P	P	E

Table 3C. Corn Herbicide Weed Control Ratings (Preemergence Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent G - Good F - Fair P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
metolachlor + or/ atrazine + linuron	DUAL + atrazine* or PRIMEXTRA + LOROX, AFOLAN F	preemergence	E	F	E	E	E	E	E	E	E	E	F	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolaclor + dicamba/atrazine	DUAL + MARKSMAN	preemergence	E	G	E	E	E	E	E	E	E	E	G	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metribuzin + atrazine + metolachlor or metolachlor/ atrazine	SENCOR plus atrazine* + DUAL or P RIMEXTRA	preemergence	E	G	E	E	E	E	E	E	E	P	E	E	E	G	E	E	P	P	P	P	P	P	P	P	G
simazine	PRINCEP NINE-T	preemergence	E	F	E	E	E	E	E	E	E	P	F	E	G	F	E	E	P	P	P	P	F	F	P	P	E

- *Various formulations available, see Table 1.*

Postemergence

NOTE: Apply all treatments in 150 to 300 L water per hectare unless specified otherwise.

Seedling annual broadleaf weeds (5 to 10 cm)	atrazine* ATRAZINE 500 (500 g/L) ATRAZINE 90W (90 WP) plus oil	 1.000 to 1.500 kg/ha 2.00 to 3.00 L/ha 1.22 to 2.78 kg/ha 10.00 to 17.00 L/ha	For increased activity and extended period of activity, apply in an oil water emulsion of 10 to 17 L of emulsifiable light mineral oil and 150 to 200 L of water per hectare. Available as a formulated mixture such as ATRAMIX or AATREX PLUS. Apply when most weeds have emerged. The low rate can be used successfully with later cultivation.
	atrazine/ simazine (1:1) EKKO (80 WP) plus oil	2.600 to 3.400 kg/ha 3.25 to 4.25 kg/ha 10.00 to 17.00 L/ha	Apply in oil water emulsions. See atrazine above. Simazine is more persistent than atrazine. CORN should be planted again the next year. See notes on atrazine and simazine soil residues.

	atrazine	1.000 kg/ha	This combination can be applied as a sequential treatment with a preemergent grass herbicide or in fields without grass infestation. Only escaping grasses up to the 3 leaf stage are suppressed with this combination.
	ATRAZINE 500 (500 g/L)	2.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 kg/ha	
	plus pyridate	0.450 kg/ha	
	LENTAGRAN (45 WP)	1.00 kg/ha	
Seedling annual weeds including crabgrass and fall panicum; broadleaf weeds (5 to 10 cm); grasses maximum 2 leaf stage	cyanazine	2.250 kg/ha	Use only the wettable granule formulation, as the suspension may cause corn burning. DO NOT add oil or surfactants. DO NOT treat corn beyond the 3 leaf stage. Corn injury may occur during cold weather and under flooding conditions.
	BLADEX NINE-T (90 WG)	2.50 kg/ha	
	cyanazine	1.801 to 2.252 kg/ha	Use only the wettable granule formulation of cyanazine. Excellent control of annual weeds can be obtained if applied before grasses reach the 2 leaf stage. Use the low rate on coarse textured soils. DO NOT treat corn beyond the 3 leaf stage. Use this triazine mixture where barnyard grass may be a problem. DO NOT add oil or surfactants. Corn injury may occur during cold weather and under flooding conditions.
	BLADEX NINE-T (90 WG)	2.00 to 2.50 kg/ha	
	plus atrazine*	1.100 kg/ha	
	ATRAZINE 90W (90 WP)	1.22 kg/ha	
	AATREX NINE-O (90 WG)	1.22 kg/ha	
Annual grasses including fall panicum and crabgrass.	metolachlor	1.923 to 2.644 kg/ha	Apply along with atrazine or cyanazine (BLADEX NINE-T only) for control of broadleaf weeds. Corn should be at the spike to 2 leaf stage and annual grasses not beyond 2 leaf stage. DO NOT add oil or surfactants.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
Seedling annual weeds including crabgrass and fall panicum; broadleaf weeds (5 to 10 cm); grasses maximum 2 leaf stage	metolachlor	1.920 to 2.640 kg/ha	High rates should be used for heavy grass infestation areas and for fall panicum control. Corn should be at the spike to 2 leaf stage. DO NOT add oil or surfactans to this mixture.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	plus atrazine*	1.000 to 1.500 kg/ha	
	ATRAZINE 500 (500 g/L)	2.00 to 3.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 to 1.67 kg/ha	
	or metolachlor/ atrazine (3:2)	3.250 to 4.250 kg/ha	
	PRIMEXTRA ((3:2) 500 g/L)	6.50 to 8.50 L/ha	
	metolachlor	1.920 to 2.640 kg/ha	Use only the wettable granule formulation of cyanazine. Apply the tank mix when corn is spike to 2 leaf and annual grasses are not beyond the 2 leaf stage. DO NOT add oil or surfactants. Corn injury may occur during cold weather and under flooding conditions.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	plus cyanazine	1.802 to 2.252 kg/ha	
	BLADEX NINE-T (90 WG)	2.00 to 2.50 kg/ha	
Seedling annual weeds including crabgrass and fall panicum and triazine resistant annual broadleaf weeds; grasses maximum 2 leaf stage.	metolachlor	1.920 to 2.640 kg/ha	Application can be made when the corn is in the spike to 2 leaf stage and annual grasses are not beyond the 2 leaf stage. See special notes on postemergence use of dicamba and related hormone chemicals.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	plus dicamba/ atrazine	1.434 to 1.744 kg/ha	
	MARKSMAN ((1:2) 388 g/L)	3.70 to 4.50 L/ha	
Seedling annual broadleaf weeds and triazine resistant broadleaf weeds	atrazine*	1.000 to 1.500 kg/ha	This treatment will provide good to excellent control of broadleaf weeds including those triazine resistant and velvetleaf. DO NOT use on sweet corn. See special notes for corn regarding dicamba applications.
	ATRAZINE 500 (500 g/L)	2.00 to 3.00 L/ha	
	AATREX NINE-O (90 WG)	1.11 to 1.67 kg/ha	
	plus dicamba	0.288 kg/ha	
	BANVEL 480 (480 g/L)	0.60 L/ha	

	dicamba/ atrazine (1:2) MARKSMAN ((1:2) 388 g/L)	1.434 to 1.744 kg/ha 3.70 to 4.50 L/ha	Application can be made up to 13 cm standing corn (5 leaf). Use the lower rate on coarse textured soils and the higher rate on medium to fine textured soils. See special notes on postemergence use of dicamba and related hormone chemicals.
	atrazine* AATREX (480 g/L) AATREX NINE-O (90 WG) plus 2,4-D/ dicamba/ mecoprop KILMOR (485 g/L)	 1.010 to 1.490 kg/ha 2.10 to 3.10 L/ha 1.12 to 1.65 kg/ha 0.413 kg/ha 0.85 L/ha	Apply as an overall spray until corn is 10 cm high (leaf extended) and before broadleaf weeds reach 10 cm in height. DO NOT apply to sweet corn. DO NOT add oil or surfactant. See special notes on postemergence use of dicamba and related hormone.
Seedling annual weeds including crabgrass, fall panicum and triazine resistant broadleaf weeds; grasses maximum 2 leaf stage	cyanazine BLADEX NINE-T (90 WG) plus dicamba BANVEL 480 (480 g/L)	2.250 kg/ha 2.50 kg/ha 0.288 kg/ha 0.60 L/ha	Use only the wettable granule formulation of cyanazine. Excellent control of annual weeds can be obtained if applied before grasses reach the 2 leaf stage. Dicamba will control velvetleaf and triazine resistant broadleaf annual weeds. DO NOT apply to sweet corn. DO NOT add oil or surfactant. DO NOT treat field corn beyond the 3 leaf stage.
	cyanazine BLADEX NINE-T (90 WG) plus atrazine AATREX (480 g/L) AATREX NINE-O (90 WG) plus dicamba BANVEL 480 (480 g/L)	1.800 to 2.252 kg/ha 2.00 to 2.50 kg/ha 1.100 kg/ha 2.29 L/ha 1.22 kg/ha 0.288 kg/ha 0.58 L/ha	Use only the wettable granule formulation of cyanazine. The addition of atrazine will improve control of barnyard grass and pigweeds. Excellent control of annual grasses can be obtained if not beyond the 2 leaf stage at application. DO NOT apply to sweet corn, add oil or surfactant, or treat corn beyond 3 leaf stage.
Emerged broadleaf annuals including triazine resistant strains	bromoxynil PARDNER (280 g/L)	0.280 to 0.336 kg/ha 1.00 to 1.20 L/ha	Controls most annual broadleaf weeds, including triazine resistant species at the 1 to 4 leaf stage. Bromoxynil is a contact herbicide and is non volatile.
	MCPA MCPA AMINE (500 g/L)	0.380 to 0.630 kg/ha 0.76 to 1.26 L/ha	Controls triazine resistant and most other broadleaf weeds. Treat before the corn reaches 15 cm tall (leaf extended). Use the lower rate for small, actively growing weeds and the higher rate for larger weeds or under adverse weather conditions. Top growth of fully developed HORSETAIL (15-25 cm) can be controlled with 1 L/ha of product; a directed late post application using drop nozzles to avoid corn injury is necessary
Emerged broadleaf annuals, including triazine resistant strains and wild mustard	bromoxynil/ MCPA (1:1) BUCTRIL M ((1:1) 560 g/L)	0.558 kg/ha 1.00 L/ha	Controls most annual broadleaf weeds up to the 4 leaf stage (lamb's-quarters and mustards to 8 leaf stage). Use in preference to bromoxynil when wild mustard is a particular problem. Apply from the 4 to 6 leaf stage of corn but not after the 6 leaf stage.
Emerged broadleaf annuals, including triazine resistant strains, 1 to 4 leaf stage	bromoxynil PARDNER (280 g/L) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	0.280 kg/ha 1.00 L/ha 1.000 to 1.500 kg/ha 2.00 to 3.00 L/ha 1.11 to 1.67 kg/ha	Controls a wider spectrum of broadleaf weeds than bromoxynil alone; larger velvetleaf will be controlled. Apply from the 4 to 8 leaf stage of corn. DO NOT add oil or surfactant. DO NOT use formulated atrazine/oil products in this tank mixture.

Emerged broadleaf annuals, including triazine resistant strains	bromoxynil/ MCPA (1:1) BUCTRIL M ((1:1) 560 g/L) plus atrazine* ATRAZINE 500 (500 g/L) AATREX NINE-O (90 WG)	0.560 kg/ha 1.00 L/ha 1.100 to 1.500 kg/ha 2.20 to 3.00 L/ha 1.22 to 1.67 kg/ha	Controls a wider spectrum of broadleaf weeds than bromoxynil/MCPA alone; larger velvetleaf will be controlled. Apply from the 4 to 6 leaf stage of corn but not after the 6 leaf stage. DO NOT add oil or surfactant. DO NOT use formulated atrazine/oil products in this tank mixture.
Emerged annual broadleaf weeds, including triazine resistant strains; nutsedge, Canada thistle and suppresion of field bindweed	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.841 to 1.082 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	Reduce oil concentrate to 1 L/ha of spray solution under hot, humid weather conditions. Apply to corn at the 1 to 5 leaf stage. Control is best when the broadleaves are small and actively growing. Grasses are NOT controlled. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.84 kg active/ha) applied 10 days apart. Cool weather or drought may delay control.
	bentazon/ atrazine (1:1) LADDOK ((1:1) 400 g/L) plus ASSIST oil concentrate	0.800 to 1.600 kg/ha 2.00 to 4.00 L/ha 2.000 L/ha	The recommended rate of 1.2 to 1.6 kg of bentazon/atrazine (3 to 4 L/ha LADDOK) may be reduced to 0.8 to 1.0 kg/ha (2.0 to 2.5 L/ha LADDOK) if metolachlor has been applied at the recommended rate for preemergence grass control. This treatment will control annual nightshade, redroot pigweed, lamb's-quarters, common ragweed, corn spurry, lady's-thumb, wild mustard and velvetleaf. Use LADDOK at 3 to 4 L/ha for nutsedge control; repeat 7 to 10 days if necessary.
Emerged broadleaf annuals, including triazine resistant strains and some broadleaf perennials	2,4-D* 2,4-D (500 g/L)	0.500 kg/ha 1.00 L/ha	Apply as an overall spray until corn is 15 cm high (leaf extended); thereafter, use drop nozzles. use amine formulation. See special notes on postemergence use of 2,4-D and related hormone chemicals. DO NOT add oil or surfactant.
Emerged broadleaf annuals, including triazine resistant strains, Canada thistle, sow-thistle, field bindweed, and wild buckwheat	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply when corn is 30 to 60 cm high, using drop pipes. See special notes on postemergence use of MCPB/MCPA and related hormone chemicals. DO NOT add oil or surfactant. Some control of field horsetail may be obtained with the higher rates of MCPB/MCPA
Emerged broadleaf annuals, including triazine resistant strains, sow-thistle, wild buckwheat, field bindweed (bloom stage) and Canada thistle (bud stage)	2,4-DB* 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.100 to 1.500 kg/ha 2.75 to 3.75 L/ha 1.76 to 2.40 L/ha	See remarks for MCPB/MCPA and special notes on postemergence use of 2,4-DB and related hormone chemicals. DO NOT add oil or surfactant. 2,4-DB will not control field horsetail.
Emerged broadleaf annuals, including triazine resistant strains, sow-thistle, wild buckwheat, and lady's-thumb, Jerusalem artichoke, field bindweed (bloom stage), Canada thistle (bud stage)	2,4-D/ dicamba/ mecoprop KII MOR (485 g/L)	0.413 to 0.534 kg/ha 0.85 to 1.10 L/ha	Apply an overall spray until corn is 15 cm high (leaf extended): therefater use drop nozzles. Jerusalem artichoke (30-40 cm in height) can be controlled with 2 sprays (10-14 days apart) per season for 2 seasons (see specific label instructions). DO NOT add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals.
	dicamba BANVEL 480 (480 g/L)	0.288 to 0.600 kg/ha 0.60 to 1.25 L/ha	Application of the lower rate can be made up to 20 cm standing corn. Drop pipes should be used when corn is 20 cm to 50 cm tall: The 0.6 kg/ha rate commonly referred to as the overlay treatment is particularly effective in controlling velvetleaf and providing extended residual control of other late germinating deep rooted

			broadleaf annuals and can be applied from the spike stage to the 5 leaf stage (13 cm standing corn). DO NOT use on sweet corn or add oil or surfactant. See special notes on postemergence use of dicamba and related hormone chemicals. DO NOT use dicamba if temperature exceeds 25C at the time of application, or if high humidity is expected, due to the possibility of dicamba volatilizing and injury to susceptible crops nearby. See precautions in SPECIAL NOTES ON CORN.
	dicamba BANVEL 480 (480 g/L) plus 2,4-D* 2,4-D (500 g/L)	0.140 kg/ha 0.29 L/ha 0.400 kg/ha acid 0.80 L/ha	Application can be made up to 10 cm standing corn. Drop pipes should be used when corn is 10 cm to 50 cm tall. DO NOT use on sweet corn, or add oil or surfactant. Use amine formulation of 2,4-D. See special notes on postemergence use of dicamba and 2,4-D and related hormone chemicals. See precauctions in SPECIAL NOTES ON CORN.

* *Additional formulations are available. See Table 1 and use rates that give comparable amounts of active ingredient.*

Directed Postemergence

Emerged weed vegetation including nutsedge (up to 15 cm high) and horsetail	linuron* AFOLAN F (480 g/L) LOROX DF (50 DF)	1.106 to 2.260 kg/ha 2.30 to 4.70 L/ha 2.20 to 4.50 kg/ha	Apply in oil water emulsion as directed spray at low pressure with drop nozzles after corn is 30 cm or more in height. The spray must be placed under the corn leaves but on the weeds. Use this treatment as a rescue from weeds escaping a previous treatment. DO NOT apply linuron after corn is beginning to tassel. Follow label directions carefully.

Spot Treatment

Emerged Canada thistle	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	DO NOT apply after corn has started to silk. Corn will be killed in the areas sprayed and may be damaged by spray drift in adjacent areas. Knapsack application of 100 mL ROUNDUP in 5 L of water applied to thoroughly wet the foliage, but not to runoff, is suggested for small areas to reduce drift and area of corn killed. Apply after field bindweed has reached full flowering, Canada thistle has started flowering or milkweed has reached the bud stage.
Emerged milkweed and field bindweed	glyphosate* ROUNDUP (356 g/L)	2.491 to 4.270 kg/ha 7.00 to 12.00 L/ha	See remarks above.

Split Applications

NOTE: Preplant incorporated herbicide treatments followed by preemergence or postemergence treatments offer many split applications or sequential combinations or programs. Similarly, preemergence treatments may be followed by postemergence herbicides for broad spectrum weed control. The combination of a herbicide whose strength is killing annual grasses with a herbicide whose strength is mainly broadleaf and/or triazine resistant weed control is recommended. See recommendations on preceding pages for details about each herbicide. For sequential or split applications use one herbicide from the left hand column for annual grass control and combine or program it with one of the herbicides from the right hand column for annual broadleaf weed control. DO NOT TANK MIX ANY OF THE COMBINATIONS NOT REGISTERED OR RECOMMENDED.

Herbicides Controlling Most Annual Grasses	Applied	Herbicides Controlling Most Annual Broadleaf Weeds	Applied
butylate+(SUTAN+)	ppi	atrazine*	ppi,pre,post
EPTC+(ERADICANE)	ppi	cyanazine(BLADEX)	ppi,pre,post

metolachlor(DUAL)	ppi,pre,post
simazine*	ppi,pre,post
dicamba(BANVEL)	pre,post
linuron*	pre,dir.post
bentazon(BASAGRAN)	post
bentazon/atrazine(LADDOK)	post
bromoxynil	post
bromoxynil/MCPA(BUCTRIL M)	post
2,4-D*	post
2,4-DB*	post
MCPA	post
MCPB/MCPA(TROPOTOX PLUS)	post
2,4-D/mecoprop/dicamba*	post
dicamba/atrazine	post

---

* *Additional formulations are available. See Table 1 and use rates that give comparable amounts of active ingredient.*

Table 3D. Corn Herbicide Weed Control Ratings (Postemergence Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E- Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method[1] of Application**	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
atrazine + dicamba	atrazine* + BANVEL	post	E	E	E	E	E	E	E	E	E	E	E	G	P	P	F	G	P	G	P	P	F	F	E	G	E
atrazine + dicamba/2,4-D/ mecoprop	AATREX + KIL-MOR	post	E	E	E	E	E	E	E	E	E	E	E	F	P	P	F	P	P	G	P	P	P	P	E	G	G
atrazine + oil	atrazine* + oil	post	E	F	E	E	E	E	E	E	E	P	F	E	P	P	G	G	P	F	F	P	F	F	F	P	G
atrazine/simazine + oil	EKKO + oil	post	E	F	E	E	E	E	E	E	E	P	G	E	F	F	E	E	P	P	F	P	F	F	F	F	G
bentazon	BASAGRAN	post	F	E	E	E	G	E	G	F	E	E	E	P	P	P	P	P	P	F	P	P	G[2]	P	G[2]	G[2]	E
bentazon/atrazine	LADDOK	post	E	E	E	E	E	E	E	E	E	E	E	P	P	P	P	P	P	F	P	P	G[2]	P	F	F	E
bromoxynil	PARDNER	post	E	G		E	E	G	E	G	E	E	E	P	P	P	P	P	P	F	P	P	P	P	F	F	E
bromoxynil/MCPA	BUCTRIL M	post	E	E		E	E	E	E	G	E	E	E	P	P	P	P	P	P	F	F	P	P	P	F	F	G

Table 3D. Corn Herbicide Weed Control Ratings (Postemergence Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E- Excellent G - Good F - Fair P - Poor

			ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method[1] of Application	buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
bromoxynil + atrazine	PARDNER + atrazine*	post	E	E	E	E	E	E	E	E	E	E	E	F	P	P	F	F	P	F	P	P	P	P	F	F	E
bromoxynil/MCPA + atrazine	BUCTRIL M + atrazine*	post	E	E	E	E	E	E	E	E	E	E	E	F	P	P	F	F	P	F	F	P	F	P	F	F	G
cyanazine	BLADEX	post	G	G		G	E	E	E	F	E	P	G	F	E	G	E	E	P	P	P	P	P	P	P	P	G
cyanazine + atrazine	BLADEX + atrazine*	post	E	G	E	E	E	E	E	E	E	P	G	G	E	G	E	E	P	P	P	P	P	P	P	P	G
cyanazine + atrazine + dicamba	BLADEX + AATREX + BANVEL	post	E	E	E	E	E	E	E	E	E	E	E	G	E	G	E	E	P	F	P	P	P	P	E	F	G
cyanazine + dicamba	BLADEX + BANVEL	post	E	E	E	E	E	E	E	E	E	E	E	F	E	G	E	E	P	F	P	P	P	P	E	F	G
2,4-D	2,4-D*	post	F	G	P	F	E	E	F	E	E	G	E	P	P	P	P	P	P	F	P	P	P	P	G	G	G
2,4-DB, MCPB/MCPA	2,4-DB*, TROPOTOX PLUS	post	G	G	P	P	F	G	F	E	E	E	E	P	P	P	P	P	P	G	P	P	P	P	G	G	G
dicamba	BANVEL	post	E	E	E	E	E	F	E	E	E	E	E	P	P	P	P	P	P	G	P	P	P	P	E	G	E
dicamba + 2,4-D	BANVEL + 2,4-D*	post	E	E	E	E	E	E	E	E	E	E	E	P	P	P	P	P	P	G	P	P	P	P	E	G	G
2,4-D/mecoprop/ dicamba	KIL-MOR	post	E	E	E	E	E	E	E	E	E	E	E	P	P	P	P	P	P	E	P	P	P	P	E	G	G
dicamba/atrazine	MARKSMAN	post	E	E	E	E	E	E	E	E	E	E	E	F	P	P	F	F	P	G	P	P	P	P	G	G	E
linuron	AFOLAN, LOROX	dir-post	E	E	E	E	E	E	E	E	E	E	E	E	F	E	G	E	G	F	G	F	G	F	G	F	G
MCPA (amine)	MCPA	post		F	F	P	E	E		F	E	E	F	P	P	P	P	P	P	F	G	P	P	P	F	F	G
metolachlor + or/ atrazine	DUAL + atrazine* or PRIMEXTRA	post	E	F	E	E	E	E	E	E	E	P	F	E	E	F	E	E	P	P	P	P	F	F	F	P	E
metolachlor + atrazine/dicamba	DUAL + MARKSMAN	post	E	E	E	E	E	E	E	E	E	E	E	E	E	G	E	E	P	G	P	P	P	P	G	G	E

Table 3D. Corn Herbicide Weed Control Ratings (Postemergence Applications)

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E- Excellent, G - Good, F - Fair, P - Poor

Treatment	Trade Name	Method[1] of Application	ANNUAL BROADLEAVES											ANNUAL GRASSES						PERENNIALS							CROP TOLERANCE
			buckwheat, wild	cocklebur	corn spurry	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	triazine resistant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	
metolachlor	DUAL	post	P	P	P	P	P	P	G	P	P	P	P	E	E	G	E	E	P	P	P	P	P	P	P	P	E
metolachlor + cyanazine	DUAL + BLADEX	post	G	G		G	E	E	E	F	E	P	G	E	E	G	E	E	P	P	P	P	P	P	P	P	G
pyridate + atrazine	LENTAGRAN + atrazine*	post	F			F	E	G	E	E	E	E	G	F	P		F										E

* *Various formulations available, see Table 1.*

[1] *post = postemergence; dir-post = directed postemergence.*

[2] *Good control of these perennials may require two applications of bentazon + ASSIST about 7 to 10 days apart.*

SPECIAL NOTES FOR CORN, FIELD AND SWEET

POSTEMERGENCE WITH 2,4-D, MCPA, MCPB, 2,4-DB, DICAMBA and KIL-MOR

2,4-D, 2,4-DB, MCPA, dicamba, KIL-MOR and some mixtures are needed for control of such weeds as thistles, field bindweed, and triazine-resistant weeds.

Postemergence treatment with 2,4-D can be combined with cultural practices for the control of a wide range of weeds. After the crop is sown, use the rotary hoe, finger weeder, or light harrows to control weed seedlings until the corn is about 5 to 15 cm high (leaf extended). Then apply an overall spray of 2,4-D.

Some varieties of corn become increasingly susceptible to damage from 2,4-D beyond the 15 cm height (leaf extended) but if many broadleaf weeds are present in the rows, spraying is still recommended provided that drop pipes are used on the sprayer to direct the spray to the base of each corn plant, thus missing the corn leaves.

Do not cultivate until at least 2 weeks after 2,4-D spray treatment, and then only if necessary. Corn is often brittle for a period of time after spraying and may be damaged by equipment. Cultivation may also damage the shallow feeding roots of corn, as well as bringing ungerminated weed seeds to the ground surface. Following a period of drought, avoid 2,4-D application for at least a week after a good rain or irrigation.

The recommended 2,4-D treatments will control the top growth and reduce the competition of the more common broadleaved perennial weeds.

2,4-DB and mixtures of MCPB and MCPA (15:1) can be used on corn at higher rates than 2,4-D and therefore will give better control of Canada thistle, sow-thistle, field bindweed and wild buckwheat. These materials should be applied when the corn is 30 to 60 cm high, using drop pipes. Spot treatment is often possible.

Dicamba, dicamba + 2,4-D tank mix or KIL-MOR provide good control of such difficult weeds as field bindweed and Canada thistle. Drop pipes should be used when Canada thistle is in the bud stage and field bindweed is at the early flowering stage.

Precautions: DO NOT use 2,4-D, MCPA, MCPB, 2,4-DB, dicamba, or KIL-MOR later than 2 weeks prior to silking and tasseling. Extreme care must be used when applying these herbicides near susceptible crops because of possible herbicide movement. Soybeans, tomatoes and tobacco are extremely sensitive to dicamba and KIL-MOR and injury symptoms may persist for several weeks. DO NOT use dicamba in the area of susceptible crops when temperatures exceed 25C on the day of application or if high humidity is expected, due to the possibility of dicamba volatilizing and injuring susceptible crops nearby. Several rows of corn should be left unsprayed when adjacent to soybean fields or other susceptible crops (use precautions on back cover).

TRIAZINE-RESISTANT ANNUAL WEEDS Strains of lamb's-quarters, pigweed, ragweed and old witch grass have been found that are resistant to high rates of all TRIAZINE herbicides including atrazine, cyanazine and simazine. These triazine-resistant species have been found in corn growing areas across Ontario. These strains cannot be visibly distinguished from the susceptible strains. Preemergence treatment with dicamba or linuron or postemergence treatment with bentazon, bromoxynil, 2,4-D, dicamba, KIL-MOR or directed linuron will usually give control of the broadleaf species (see appropriate sections above). The grasses can be controlled with butylate[+], EPTC[+], or metolachlor (see sections above.).

NOTES ON ATRAZINE AND SIMAZINE SOIL RESIDUES Atrazine and simazine residues may last for more than one year, particularly if high rates are used more than once and dry weather occurs. if atrazine or simazine is used year after year as in a continuous corn program, triazine residues may be higher. Atrazine when used at rates from 1.2 to 1.5 kg (active) per hectare **(2.4 to 3.0 L of (500 g/L) or 1.2 to 1.7 kg of (90 WG) PRODUCT)** on corn generally has not caused injury on succeeding crops of oats, barley, mixed grains, or soybeans, except in years where there was very little rain the previous fall which would slow down atrazine degradation in the soil. Postemergence treatments may persist longer than preemergence treatments. Variations from this generality of 1.2 to 1.5 kg/ha atrazine may occur across the province.

Injury has been reported on tomatoes, white beans, forage seedings, peas, tobacco, cucumbers, onions, and turnips following applications of atrazine at more than 1.1 kg (active) per hectare **(2.2 L of (500 g/L) or 1.2 kg of (90 WG) PRODUCT)** on corn the previous year.

Where crops are to be grown that are extremely sensitive (such as tobacco and vegetable crops) to atrazine, use combinations of butylate[+] or EPTC[+] with cyanazine as a preplant incorporated treatment or the combination of metolachlor plus cyanazine as a preemergence treatment.

To reduce the hazard of atrazine residues on succeeding crops:

1. Apply the early postemergence atrazine oil-water treatment with the lower rate of atrazine: 1.1. kg (active) **(2.2 L of (500gL) or 1.2 kg of (90 WG) PRODUCT)** per hectare. With this lower rate, a lower measure of weed control may result and cultivations may be necessary.
2. Apply an early postemergence treatment of atrazine using 1.1. kg (active) per hectare **(2.2 L of (500 g/L) or 1.2 kg of (90 WG) PRODUCT)** plus 0.55 kg of 2,4-D acid per hectare **(1.1 L of 2,4-D AMINE (500 g/L) PRODUCT)**. This may also require one shallow cultivation to control weed escapes. 2,4-D is useful in this mixture where perennial weeds such as Canada thistle, sow-thistle, and curled dock are present.
3. Use the combination of cyanazine, linuron, or metolachlor with atrazine applied preemergence, or EPTC[+] or butylate[+] with atrazine applied preplant incorporated.
4. Fall plowing will reduce TRIAZINE injury more than will spring plowing.
5. Mold board plowing will disperse herbicide residue to a greater soil depth than chisel plowing, thus reducing the concentration of herbicide in the upper soil area.
6. Ensure that the sprayer used is adequate and is properly calibrated and adjusted. Spray uniformly without overlaps and do not spray while the sprayer is stopped.

Atrazine + simazine has an increased soil residue because of the higher rate of triazines used. This mixture should be used only where corn is to follow corn.

If a residue problem is anticipated, contact your local Extension Personnel for information on soil analysis procedures for triazine residues.

OIL AND SURFACTANTS WITH ATRAZINE OR ATRAZINE/SIMAZINE MIXTURES Several blends of OIL* and SURFACTANTS in varying proportions are available for use for postemergence application. The rate of application will vary from 10 to 17 L per hectare for the lowest SURFACTANT content (approx. 1%) to 2.5 to 5 L per hectare for the higher SURFACTANT content (approx. 20%) to 0.5 to 1 L per hectare for undiluted SURFACTANTS.

These materials are sold under various trade names. Follow the label directions closely for best results.

In general, OILS (approx. 1% SURFACTANT) have given best results under adverse conditions. These conditions include use on quack grass, nutsedge and heavy infestations of annual grasses or when weeds have developed under dry or cool conditions and are more difficult to control. Instances of early injury on corn have been reported, especially during cold weather, but it may also occur under other conditions of stress such as hot, dry weather. The corn usually has recovered.

The OIL-SURFACTANT mixtures (approx. 20% SURFACTANT) and the undiluted SURFACTANTS should be considered where quack grass, nutsedge or annual grasses are not a serious problem, in an effort to reduce the volume transported when spraying large acreages. Time of application of the oil-surfactant mixtures, or undiluted surfactant, is the same as with OIL-WATER. Early corn injury seldom occurs with these two materials, but injury may occur if corn is sprayed when more than 25 cm high (leaf extended). Use only commercial mixtures of OIL or SURFACTANTS.

Do not use 2,4-D, MCPA, MCPB/MCPA, 2,4-DB, dicamba, KIL-MOR, metolachlor, or cyanazine in conjunction with OIL-WATER emulsions or SURFACTANTS.

** Oil should be light paraffin based mineral oil having 70-105 S.U.S. viscosity with over 75% unsulfonatable residues and suitably emulsified.*

FLAX-LINSEED

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant and Post Harvest			
Emerged quackgrass	glyphosate** ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	A minimum of 2 seasons control. Apply in 100-300 L/ha of water when the quackgrass is actively growing with at least 4 new leaves on each emerged shoot. Spring application may delay planting and thereby reduce grain yield. (Important: see "Notes on Chemicals" section for more information.)
	glyphosate** ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	For a minimum of 1 season control. Apply in the fall or in the spring before planting when the quackgrass is actively growing with at least 4 new leaves on each emerged shoot. Apply with flat-fan nozzle tips in 50 to 100 L/ha of water. For use in higher water volumes, the addition of a surfactant Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

*** Additional glyphosate products are available. See Table 1.*

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Postemergence			
Mustards, lady's-thumb, wild buckwheat and many other emerged broadleaf weeds	bromoxynil/ MCPA (1:1)* BUCTRIL M ((1:1) 560 g/L)	0.560 kg/ha 1.00 L/ha	Apply when the flax is 5 to 10 cm high before weeds have developed beyond the 4 leaf stage. Do not use if the daytime temperature is over 29C.
Mustard and many other emerged annual broadleaf weeds	MCPA* ESTAMINE MCPA (500 g/L)	0.420 to 0.550 kg/ha 0.84 to 1.10 L/ha	Flax may be treated when 5 cm tall to bud stage. Best weed control is obtained if the application is made when the weeds are small (approx. 5 cm tall).
	2,4-D* 2,4-D (500 g/L)	0.350 kg/ha 0.70 L/ha	Treat when flax is 5 cm high to bud stage. Weeds should be small when sprayed (approx. 5 cm tall).
Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle and some suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.833 kg/ha 1.73 L/ha 2.000 L/ha	Apply when flax is 5 cm or higher and weeds are small and actively growing. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.84 kg active/ha); 10 days apart may be required. A new flush of weeds may emerge after the first flush has been controlled. Cool weather or drought may reduce control. Reduce rate of oil concentrate with BASAGRAN to 1 L/ha under abnormally hot and humid weather conditions or temporary crop injury may occur.

Emerged annual grasses including wild oats	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.710 to 0.795 kg/ha 2.50 to 2.80 L/ha	Apply in the spring when annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha) must be used for control of wild oats in the 4 to 5 leaf stage. Do not use if rain is expected within 1 hour after application.
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2 litres per hectare) when quackgrass is present. See "Notes on Chemicals" section.AGRAL 90 to be applied at 1 litre in 1000 litres of spray solution.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.140 to 0.290 kg/ha 0.76 to 1.57 L/ha 2.000 L/ha 1.000 L/ha	Flax is tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Apply in 50 to 200 L/ha water with 275 to 425 kPa pressure and flat-fan nozzles angled forward 45 degrees. Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after treatment.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Thorough preplanting tillage will ensure more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110-200 L/ha of water. Use MERGE at a rate of 1% v/v. Quackgrass control will be provided for 6-8 weeks.
	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate plus ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L)	0.490 kg/ha 2.66 L/ha 2.000 L/ha 2.000 kg/ha 4.08 L/ha	Thorough preplanting tillage will ensure more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110-200 L/ha of spray solution. A maximum of 8 weeks control of quackgrass can be expected.
Emerged annual broadleaf weeds and grasses	sethoxydim POAST (184 g/L) plus bromoxynil/ MCPA (1:1)* BUCTRIL M ((1:1) 560 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.149 to 0.295 kg/ha 0.81 to 1.60 L/ha 0.560 kg/ha 1.00 L/ha 2.000 L/ha 1.000 L/ha	Apply when flax is 5 to 10 cm high before weeds have developed beyond the 4 leaf stage. Do not use if the daytime temperature is over 29C. Apply in 50 to 200 L/ha of water with 275 to 425 kPa pressure and flat-fan nozzles angled forward 45 degrees.
	sethoxydim POAST (184 g/L) plus MCPA MCPA AMINE (500 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.295 kg/ha 0.80 to 1.60 L/ha 0.420 to 0.550 kg/ha 0.84 to 1.10 L/ha 2.000 L/ha 1.000 L/ha	Flax may be treated when 5 cm tall to bud stage. Best weed control is obtained if the application is made when the weeds are small (approximately 5 cm tall). Apply in 50 to 200 L/ha of water with 275 to 425 kPa pressure and flat-fan nozzles angled forward 45 degrees.
Wild oats	triallate AVADEX BW (400 g/L)	1.700 to 2.200 kg/ha 4.25 to 5.50 L/ha	Triallate can be applied before or after seeding and must be worked into the soil to control wild oats. Consult the label for complete directions.

Barnyard grass, green foxtail, wild oats, volunteer wheat, volunteer barley, and quackgrass	quizalofop-ethyl ASSURE (96 g/L) plus oil concentrate CANPLUS 411	0.096 to 0.148 kg/ha 1.00 to 1.54 L/ha	Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and quackgrass in the 2 to 6 leaf stage. Use the higher rate for control of quackgrass. Use the higher rate of Canplus 411 when wild oats and quackgrass are the target weeds or under drought conditions. Do not apply to flax within 82 days of harvest. Add CANPLUS 411 at 5 to 10 litres per 1000 litres of spray solution.
Harvest-Aid			
Harvest-Aid to burn off weeds	diquat REGLONE (200 g/L) plus AGRAL 90	0.300 to 0.550 kg/ha 1.50 to 2.75 L/ha	Apply by aircraft in at least 20 L of water/ha when the crop is at 75% boll turn stage. Do not apply to immature crop. This application reduces dry down time and eliminates the need for swathing.AGRAL 90 to be applied at 1 litre in 1000 litres of spray solution.

* *Additional formulations are available. Use rates thct give comparable amounts of active ingredient. See Table 1.*

** *Additional glyphosate products are available. See Table 1.*

FORAGE LEGUMES (DIRECT SEEDED)

NOTE: Apply all treatments in 100 to 200 L water per hectare except where otherwise noted.

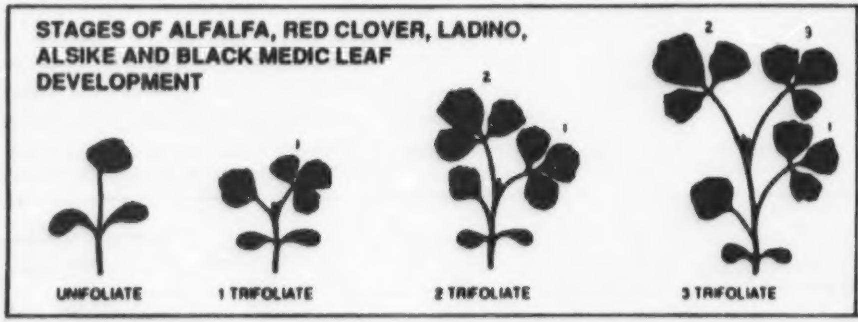
WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Nutsedge and many germinating grass and broadleaf weeds	EPTC EPTAM (800 g/L)	3.400 kg/ha 4.25 L/ha	Before seeding pure stands of alfalfa or bird's-foot trefoil apply to a dry soil surface and incorporate into the soil immediately. Some broadleaf weeds such as ragweed, mustards, and pigweed frequently escape.
Germinating annual grasses and good control of lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.148 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.40 L/ha 1.50 to 2.75 L/ha	Incorporate into the soil before seeding pure stands of alfalfa. See "Notes on Chemicals" section for details about incorporation.
Many emerged broadleaf weeds	2,4-DB* 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.100 to 1.400 kg/ha 2.75 to 3.50 L/ha 1.75 to 2.25 L/ha	Apply in 150 to 200 L water per hectare, when alfalfa, bird's-foot trefoil or clovers are in the 1 to 4 leaf stage. 2,4-DB usually suppresses legume growth for a period of 2 to 3 weeks. Under drought, high temperature or other stress conditions, 2,4-DB may severely injure legumes.
	2,4-DB COBUTOX (400 g/L) EMBUTOX 625 (625 g/L) plus MCPA ESTAMINE MCPA (500 g/L)	0.800 kg/ha 2.00 L/ha 1.25 L/ha 0.035 kg/ha 0.07 L/ha	The addition of MCPA gives better control of common mustard than 2,4-DB alone. Apply in 150 to 200 L water per hectare. Apply when the legumes are in the 1 to 4 leaf stage. (0.07 L/ha = 70 ml)
Many emerged broadleaf weeds in clovers (except sweet clover) and grasses	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply in 150 to 200 L water per hectare when legumes are in the unifoliate to the 4th trifoliate leaf stage. Clovers may be suppressed for a period of 2 to 3 weeks.

Emerged green and yellow foxtail, barnyard grass, wild oats, old witch grass and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.710 to 0.796 kg/ha 2.50 to 2.80 L/ha	Use on alfalfa, red or sweet clover when the grass weeds are in the 1 to 4 leaf stage. Do not apply if rain is expected within 1 hour after treatment. Broadleaf control herbicides must be applied at least 4 days before or after diclofop-methyl. Do not feed forages in the year of seeding after treatment with diclofop-methyl.
Emerged quackgrass and annual grasses in alfalfa, red clover and bird's-foot trefoil (pure legume stands only)	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.200 to 0.500 kg/ha 0.80 to 2.00 L/ha	Use the higher rate (2 litres per hectare) when quackgrass is present. Fluazifop-butyl may be tank mixed with 2,4-DB at label rates for control of a broad range of weeds. Do not use AGRAL 90 in this tank mix. DO NOT HARVEST OR GRAZE TREATED FORAGE IN THE YEAR OF APPLICATION OF FLUAZIFOP-BUTYL. See "Notes on Chemicals" for more details. AGRAL 90 to be applied at 1 litre to 1000 litres of spray solution.
Emerged annual grasses in pure alfalfa	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.295 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Alfalfa is tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1-6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Apply in 110-200 L/ha of water with 275 to 425 kPa pressure. Complete control is normally obtained 7 to 21 days after application. ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
Quackgrass and annual grasses in pure alfalfa	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will give more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Gives 6-8 weeks control of quackgrass. ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
	sethoxydim POAST (184 g/L) plus ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus ASSIST oil concentrate	0.497 kg/ha 2.70 L/ha 2.000 kg/ha 4.08 L/ha 2.000 L/ha	Thorough preplant tillage will give more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L/ha of water. Gives 6-8 weeks control of quackgrass. ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
Emerged quackgrass before seeding	glyphosate** ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	A minimum of 2 seasons control. Apply in 100-300 L/ha of water when the quackgrass is actively growing with at least 3-4 new leaves on each emerged shoot. (Important: see "Notes on Chemicals" section for more information).
	glyphosate** ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	A minimum of one season control. Apply in the previous fall or spring before seeding when quackgrass is actively growing with at least 3-4 new leaves on each emerged shoot. Apply in 50-100 L/ha of water using flat-fan nozzle tips. For use in higher water volumes, the addition of a surfactant Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

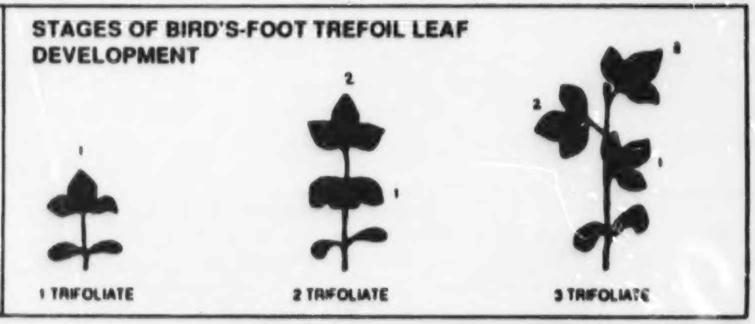
---

* *Additional formulations are available. Use rates that give comparable amounts of active ingredient. See Table 1.*

** *Additional glyphosate products area available. See Table 1.*



STAGES OF ALFALFA, RED CLOVER, LADINO, ALSIKE AND BLACK MEDIC LEAF DEVELOPMENT



STAGES OF BIRD'S-FOOT TREFOIL LEAF DEVELOPMENT

FORAGE LEGUMES (ESTABLISHED)

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Canada thistle and chicory	2,4-DB* 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.400 to 1.700 kg/ha 3.50 to 4.25 L/ha 2.25 to 2.75 L/ha	For pure stands or mixtures containing alfalfa or bird's-foot trefoil apply as spot treatment, or when regrowth after cutting or grazing is not more than 7 cm high. Apply in 150 to 200 L water per hectare.
	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.700 kg/ha 4.25 L/ha	For pure stands or mixtures containing red and alsike clovers. Apply as spot treatment, or when regrowth after cutting or grazing is not more than 7 cm high. Apply in 150 to 200 l water per hectare.
Yellow rocket and winter weeds in red clover, alfalfa and bird's-foot trefoil	2,4-DB* 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.400 kg/ha 3.50 L/ha 2.25 L/ha	Apply to actively growing weeds in September or October when regrowth after cutting or grazing is no more than 7 cm high. Apply in 150 to 200 L water per hectare.
Emerged quackgrass and annual grass in pure alfalfa, red clover or bird's-foot trefoil	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.500 kg/ha 2.00 L/ha	Apply to regrowth after cutting or grazing the forage. Quackgrass must be actively growing with 3 to 5 new leaves per shoot for effective control. DO NOT HARVEST OR GRAZE TREATED FORAGE IN THE YEAR OF APPLICATION OF FLUAZIFOP-BUTYL. See "Notes on Chemicals" for more details.AGRAL 90 to be applied at 1 litre to 1000 litres of spray solution.
Barnyardgrass, green foxtail, wild oats, volunteer wheat, volunteer barley and quackgrass in pure alfalfa.	quizalofop-ethyl ASSURE (96 g/L) plus oil concentrate Canplus 411	0.096 to 0.144 kg/ha 1.00 to 1.50 L/ha	FOR SEED ALFALFA ONLY. Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and quackgrass in the 2 to 6 leaf stage. Use the higher rate for control of quackgrass. Use the higher rate of Canplus when wild oats and quackgrass are the target weeds or under drought conditions. Apply 5-10 L in minimum of 1000 L water per hectare.

Emerged quackgrass and annual grass in pure alfalfa	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Use MERGE at a rate of 1% v/v. Quackgrass control will be provided for 6-8 weeks. ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
	sethoxydim POAST (184 g/L) plus ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus ASSIST oil concentrate	0.497 kg/ha 2.70 L/ha 2.000 kg/ha 4.08 L/ha 2.000 L/ha	Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L or water per hectare. Gives 6 to 8 weeks control of quackgrass. ALLOW 70 DAYS BETWEEN SPRAYING AND HARVEST.
To prevent establishment of many weeds in established alfalfa and bird's-foot trefoil	simazine** SIMADEX (500 g/L) PRINCEP NINE-T (90 WG)	1.100 kg/ha 2.20 L/ha 1.10 kg/ha	Do not use SIMADEX on alfalfa. Apply in September to November before freeze up. This treatment will also prevent legume seedlings from establishing for approximately 8 months. Do not use in the fall before seeding another crop. Do not apply paraquat within 1 year after simazine application. Do no apply to the same field for more than 3 consecutive years. Allow 30 days between applications and grazing cattle or sheep.
To control seedling dandelions and many other seedling weeds in pure stand of alfalfa	terbacil SINBAR (80 WP)	0.560 to 1.200 kg/ha 0.70 to 1.50 kg/ha	For use on alfalfa established at least 1 year. Apply after alfalfa is dormant in the fall or before new growth starts in the spring. Use the higher rate on clay or clay loam soils and the lower rate on sands or loams. Do not seed treated area to any crop within 2 years after the last terbacil treatment.
Control or suppression of grasses and annual weeds in bird's-foot trefoil and alfalfa fields	paraquat GRAMOXONE (200 g/L)	0.560 to 1.100 kg/ha 2.80 to 5.50 L/ha	Apply to trefoil seed fields when the crop is about 15 cm high in the spring. Apply to alfalfa or trefoil forage fields within 5 days after cutting. Slow recovery and some stand reduction has been observed under conditions of drought or high temperatures. Do not use in the spring after treatment with simazine.
Control of quackgrass and many other grasses in alfalfa and bird's-foot trefoil	propyzamide KERB (50 WP)	1.125 to 1.625 kg/ha 2.25 to 3.25 kg/ha	Apply in late September to early November before the soil freezes. Do not apply dalapon in the same fall as propyzamide.
Emerged milkweed, field bindweed, Canada thistle and common tansy	glyphosate[1] ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	Apply as spot treatment when the field bindweed has reached full bloom and other weeds are in the bud to full bloom stage. Do not graze or harvest forage from treated spots until the treated plants turn brown.
Emerged Canada thistle and perennial sow-thistle	amitrole AMITROL-T (200 g/L)	4.400 to 5.000 kg/ha 22.00 to 25.00 L/ha	Apply after the final harvest in the final year of the forage. Apply when thistle regrowth is 15 to 20 cm tall. Wait 2 weeks before plowing. Do not graze or otherwise harvest the forage after spraying.

---

* *Additional formulations are available. Use rates that give comparable amounts of active ingredient. See Table 1.*

** *SIMADEX (80WP) equivalent rate is 1.3 kg/ha.*

[1] *Additional glyphosate products are available. See Table 1.*

PASTURE RENOVATION WITH BIRD'S-FOOT TREFOIL

The introduction of this legume into a pasture requires control of competition from weeds and forage grasses for the first 2 to 4 months after the legume seed begins to germinate. Control of established perennial weeds should start at least one year before the legume seeding operation, using treatments recommended in the previous section of this publication. If the field cannot be plowed and worked to prepare a seedbed, one of the following chemical treatments can be used to suppress the sod.

The success of these programs depends on many management factors such as inoculation of the trefoil seed, and control of fertility and grazing. Consult local agricultural authorities for more information about pasture renovation.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Grass and broadleaf suppression	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Broadcast seed and fertilizer in mid-April. Apply paraquat in early May when the grass is 5-10 cm high before the legume seed germinates.
Kill or suppression of grasses and broadleaf plants	glyphosate ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	Apply when the forage grasses have at least 2 leaves.

PASTURES (Mostly Grasses)

Overgrazing tends to thin the grass stand and allows the establishment of weeds. Undergrazing allows weeds like wild carrot to form and spread seed. Timely mowing can prevent the ripening of weed seeds and reduce the distance these seeds spread with the wind.

Chemicals are available to control most of the troublesome weeds in grass pastures and these can give faster kill of established weeds than any other management practice. A chemical may have to be applied more than once to kill established perennial weeds and the new crop of weeds that emerges through a thin grass stand. A poor grass stand can be improved by using a combination of chemicals, fertility and grazing management.

Chemical weed control should extend into fencerows and other areas around the pasture to keep these areas from becoming sources of weed seeds.

Generally, clovers are severely damaged by chemical treatments. However, white clover and black medic show some resistance or re-establish quickly.

Consult the label in regard to the period of time to keep livestock out of the treated area. With most of the chemicals this will be a period of about 5 days, but with AMITROLE or AMITROLE-T it is 6 to 8 months. After glyphosate application wait until the treated plants turn brown before starting to graze the area.

Care should be taken to prevent grazing where poisonous plants (water hemlock, chokecherry, etc.) may be made more attractive to livestock after the chemical treatment. It is a good practice to prevent grazing on the field for at least a week after spraying to reduce the chances of the livestock picking up harmful plants.

Apply chemical treatments in at least 200 L of water per hectare and increase this rate if it is necessary to contact weeds through a thick volume of vegetation.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Blueweed	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply as low-volatile ester as late spring or early fall application.
Brush	See Brush Control Section		Consult label in regard to the period of time required to keep livestock out of treated area.

Burdock	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply as low volatile ester in fall or spring. This treatment will be most effective on first year rosettes.
Buttercup	MCPA* ESTAMINE MCPA (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply in June and again in early September.
Canada thistle, field bindweed	dicamba BANVEL 480 (480 g/L)	1.200 kg/ha 2.50 L/ha	Apply in late spring when the thistles are in the bud stage and the bindweed is flowering. Wait 14 days between treatment and harvest or grazing for dairy animals. Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.700 kg/ha 4.25 L/ha	This treatment has some safety on forage legumes. Use 150 to 200 L water per hectare.
	glyphosate** ROUNDUP (356 g/L)	1.673 to 4.270 kg/ha 4.70 to 12.00 L/ha	Apply as spot treatment when the thistles are in the bud to full bloom stage, and the bindweed is flowering.
Chicory	2,4-D* 2,4-D (500 g/L)	0.850 kg/ha 1.70 L/ha	Apply in late spring.
Common tansy	glyphosate* ROUNDUP (356 g/L)	2.491 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply as spot treatment when the tansy is in the bud to full bloom stage.
Dandelions	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply in May or September.
Goat's-beard	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply as early as possible on the second year's growth or early fall on the first year's growth.
	dicamba BANVEL 480 (480 g/L)	2.212 kg/ha 4.60 L/ha	Apply when actively growing. Wait 14 days between treatment and harvest or grazing for dairy animals. Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
Goldenrod	2,4-D* 2,4-D (500 g/L)	1.010 kg/ha 2.02 L/ha	Apply in June.
	dicamba BANVEL 480 (480 g/L)	1.100 kg/ha 2.29 L/ha	Apply when actively growing. Wait 14 days between treatment and harvest or grazing for dairy animals. Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
Hawksweed	2,4-D* 2,4-D (500 g/L)	1.100 to 1.750 kg/ha 2.20 to 3.50 L/ha	Apply near the end of May and early September.
Leafy spurge and cypress spurge	dicamba BANVEL 480 (480 g/L)	0.601 kg/ha 1.25 L/ha	For top growth control apply when the weed is actively growing. No delay is required between treatment and harvest or grazing for dairy animals. Meat animals

			may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
Milkweed	glyphosate** ROUNDUP (356 g/L)	4.270 kg/ha 12.00 L/ha	Apply as spot treatment when the milkweed is in the bud to bloom stage.
	amitrole AMITROL-T (200 g/L)	4.400 kg/ha 22.00 L/ha	Spray to wet before flowering. Use spot treatments. Keep animals away from the treated area for 6 to 8 months.
	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply as a late spring application emphasizing spraying of the undersides of leaves. This treatment kills top growth only.
Nodding, bull, and scotch thistle	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply late spring or early fall.
	2,4-DB* EMBUTOX 625 (625 g/L) 2,4-D BUTYRIC (400 g/L)	1.720 kg/ha 2.75 L/ha 4.25 L/ha	Apply late spring or early fall.
Ox-eye daisy	2,4-D* 2,4-D (500 g/L)	1.100 to 1.750 kg/ha 2.20 to 3.50 L/ha	Use 2 treatments, one in mid June and the second in early September if there is sufficient growth.
Tansy ragwort	2,4-D 2,4-D (500 g/L)	2.250 kg/ha 4.50 L/ha	Apply to rosettes in spring or fall. Retreatment will be necessary to control any new seedlings and regrowth.
	dicamba BANVEL 480 (480 g/L)	1.010 kg/ha 2.10 L/ha	Apply when the tansy ragwort is actively growing. Wait 7 days between treatment and harvest or grazing for diary animals. Meat animals may graze or feed in treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
Water hemlock	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply in May or June.
Wild carrot	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Apply in early fall for first year plants or early spring for second year plants. If 2,4-D resistant strains are present, mow to reduce seed spread.
	2,4-D* 2,4-D (500 g/L) plus dicamba BANVEL 480 (480 g/L)	1.100 kg/ha 2.20 L/ha 1.010 kg/ha 2.10 L/ha	Apply in early fall for control of first year plants. Wait 14 days between treatment and harvest or grazing for dairy animals. Meat animals may graze or feed in treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
Yellow rocket(winter cress)	2,4-D* 2,4-D (500 g/L)	0.850 to 1.100 kg/ha 1.70 to 2.20 L/ha	September, October or in early May before flowering. Mow if the plants are in the flowering stage.

* *Many formulations are available. See Table 1.*

** *Additional glyphosate products are available. See Table 1.*

PEANUTS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	Apply in the fall or spring to actively growing quackgrass with 3 to 4 or more leaves per shoot. Fall or spring tillage prior to spring application may reduce control. Wait at least 5 days after application before working the area. Treated quackgrass should be worked down before it turns completely brown for maximum control. Rainfall within 6 hours after application and heavy frosts (lower than -4C) may reduce control. A minimum of 2 seasons control is obtained at these rates.
	glyphosate* ROUNDUP (356 g/L)	0.835 to 0.890 kg/ha 2.35 to 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of surfactants such as Enhance or Frigate is recommended. Refer to NOTES on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.
Preplant Incorporated			
Germinating annual grasses, nutsedge and some annual broadleaf weeds	vernolate VERNAM (720 g/L)	2.240 to 2.500 kg/ha 3.11 to 3.48 L/ha	Apply preplant to a dry soil surface and incorporate immediately (within 10 minutes) after application to a depth of 10 cm using a disk (7-10 km/hr) or a vibrating shank cultivator (10-13 km/hr). A second incorporation at right angles is recommended.
Postemergence			
Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle and some suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	1.080 kg/ha 2.25 L/ha 2.000 L/ha	Apply when peanuts are in the unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled. Top growth of Canada thistle and yellow nutsdege is controlled and field bindweed may be suppressed but 2 applications of BASAGRAN at 1.75 L/ha (0.84 kg active/ha) 10 days apart may be required. A new flush of weeds may emerge after the first flush has been controlled. Temporary crop injury may occur under abnormally cool or hot, humid conditions. Reduce rate of oil concentrate to 1 L/ha when those conditions occur. Cool weather or drought may delay or reduce control.

* *LAREDO (356 g/L) and WRANGLER (356 g/L) are alternate glyphosate products.*

NOTE: All treatments should be applied in 150 to 300 L water per hectare unless otherwise specified.

Equipment used to apply DICAMBA (BANVEL), 2,4-D MCPA, MCPB, MCPB/MCPA, 2,4-DB, KIL-MOR, or related herbicides should be thoroughly cleaned up immediately after use as well as before it is used to spray soybeans. See "Cleaning the Sprayer" section.

Total Weed Control System- Although herbicides themselves may be effective, there is benefit in using all the various weed control methods available to obtain the best weed control possible. Crop rotation, herbicide rotation, early weed control with a rotary hoe, harrowing, cultivating and preventing the spread of weeds as much as possible are all a part of weed management. See the corn section for some details of each of these methods.

Triazine Residues- When soybeans follow corn treated with triazines such as atrazine or simazine the previous year, and if triazine residues remain they may interact with a number of herbicides used for weed control in soybeans to cause crop injury. Examples of soybean herbicides which may be involved include the triazine based herbicide metribuzin (Sencor or Lexone) or the substituted urea herbicides (Afolan, Afesin, Lorox or Patoran). The substituted urea herbicides are of less concern in this regard. The potential for injury is greater during adverse weather conditions, in shorter season soybean growing areas and/or in soils with a high pH. Herbicide injury symptoms should not be confused with cold injury symptoms. Also see "Notes on Atrazine and Simazine Soil Residues" which appears near the end of the corn section in this publication.

Triazine-Resistant Weeds- Biotypes of lamb's-quarters, pigweed and ragweed have been found resistant to all TRIAZINE herbicides including metribuzin (Sencor or Lexone). Resistant strains are dificult to distinguish from triazine susceptible strains. Herbicides effective for the contol of triazine-resistant weeds in the soybean crop include bentazon, chloramben, linuron, metobromuron and monolinuron. Trifluralin and ethalfluralin will control triazine-resistant lamb's-quarters, pigweed, old witch grass and green foxtail.

Specific Weeds For information on specific weeds see Table 4. Then refer to the appropriate section for details about herbicide treatments.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and Canada thistle	amitrole AMITROL-T (200 g/L)	3.400 to 4.400 kg/ha 17.00 to 22.00 L/ha	Apply to actively growing quackgrass (15-20 cm high) and Canada thistle in the fall or spring. Plow or thoroughly disk 10-14 days after application. Cultivation may be required when the crop is emerged.
Quackgrass	glyphosate ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	A minimum of 2 seasons control is obtained at these rates. Apply in fall or spring to actively growing quackgrass with 3 to 4 or more leaves per shoot. Fall or spring tillage prior to spring application may reduce control. Wait at least 5 days after application before working the area. Treated quackgrass should be worked down before it turns completely brown for maximum control. Rainfall within 6 hours after application and heavy frosts (lower than -4C) may reduce control.
	glyphosate* ROUNDUP (356 g/L)	0.837 to 0.890 kg/ha 2.35 to 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of surfactants such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels of registered rates of glyphosate, surfactants and appropriate water volumes.
Germinating and emerged annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L)	0.100 kg/ha 0.42 L/ha	Imazethapyr may be applied up to 30 days prior to planting for control of many annual grass and broadleaf weeds. Only one working of the soil to prepare a seedbed is recommended following application. This final seedbed preparation should not be deeper than 10 cm. Addition of a non ionic surfactant and liquid

			fertilizer is required if emerged weeds are present at application. Use only once per season.
Quackgrass, germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L) plus glyphosate ROUNDUP (356 g/L)	0.100 kg/ha 0.42 L/ha 0.837 to 0.890 kg/ha 2.35 to 2.50 L/ha	See imazethapyr and glyphosate instructions for details.
Germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L) plus paraquat GRAMOXONE (200 g/L)	0.100 kg/ha 0.42 L/ha 0.550 to 1.100 kg/ha 2.75 to 5.50 L/ha	See imazethapyr and paraquat instructions for details.

Preplant Incorporated

NOTE: Unless specified, apply all treatments in 150 to 300 L of water per hectare. Two incorporations at right angles operating at a depth of 10 cm using a double disk (7-10 km/hour) or vibrating shank S-tine cultivator (10-13 km/hour) are required unless otherwise stated. Lower rates are usually for sandy to sandy loam soils, higher rates for clay to clay loam soils.

Germinating annual grasses, lamb's-quarters and pigweed (including triazine resistant species), lady's-thumb and nightshade are suppressed	ethalfluralin EDGE (50 DF)	0.700 to 1.100 kg/ha 1.40 to 2.20 kg/ha	Vigorous, continuous agitation is essential for mixing. All in line screens should be 50 mesh or coarser. Incorporation instructions are similar to those for trifluralin below.
Nutsedge, germinating annual grasses, annual nightshade	metolachlor DUAL (960 g/L)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha	Applied preplant followed by one incorporation with a double disk or vibrating shank (S-tine) cultivator operating at a depth of 10 cm. Lasts 10 to 14 weeks in the soil. Effective on most soils except high organic matter, muck or peat soils.
Germinating annual grasses and some control of lamb's-quarters and pigweed including triazine resistant species	trifluralin[3] TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha	Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or vibrating S-tine cultivator (10-13 km/hr) set to work 8-10 cm deep. The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours (see labels). The second incorporation is recommended anytime before planting. See "Notes on Chemicals" section for further details. Also see labels for instructions on incorporation.
Germinating annual grasses, nutsedge	vernolate VERNAM (720 g/L)	2.250 to 3.250 kg/ha 3.13 to 4.52 L/ha	Applied preplant, followed by immediate incorporation (within 10 minutes after application). Ragweed is not controlled. Mustard and ragweed may escape. Lamb's-quarters and pigweed may be controlled. Crop injury may occur which is usually temporary unless adverse weather conditions persist during the growing season.
Germinating annual grasses and broadleaf weeds, including triazine resistant lamb's-quarters and pigweed, nightshade is suppressed	ethalfluralin EDGE (50 DF) plus (tank mix) metribuzin LEXONE DF (75 DF)[1] or SENCOR 500 F (500 g/L)[2]	0.700 to 1.100 kg/ha 1.40 to 2.20 kg/ha 0.350 to 0.526 kg/ha 0.47 to 0.70 kg/ha 0.70 to 1.05 L/ha	See the respective ethalfluralin and metribuzin labels for instructions on mixing, incorporation and other details. Incorporation instructions are similar to those for trifluralin above. Do not use on metribuzin sensitive soybean varieties such as Ace, Maple Amber, Nattawa, Baron, Apache or Maple Ridge varieties.

Nutsedge, germinating annual grasses and broadleaf weeds including nightshade, velvetleaf and cocklebur	metolachlor DUAL (960 g/L) plus (tank mix) metribuzin LEXONE DF (75 DF)[1] SENCOR 500 F (500 g/L)[2]	0.410 to 0.480 kg/ha 0.43 to 0.50 L/ha 0.420 to 0.550 kg/ha 0.56 to 0.73 kg/ha 0.84 to 1.10 L/ha	See metolachlor instructions for incorporation and metribuzin instructions for details. Note: Maximum registered Lexone 75 DF rate is 0.64 kg product/ha (0.48 active/ha). Note susceptible varieties above.
Germinating annual grasses and broadleaf weeds, including some triazine resistant annual broadleaf weed species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) plus (tank mix) metribuzin LEXONE DF (75 DF)[1] SENCOR 500 F (500 g/L)[2]	0.600 to 1.100 kg/ha 1.10 to 2.00 L/ha 1.20 to 2.20 L/ha 0.420 to 0.550 kg/ha 0.56 to 0.73 kg/ha 0.84 to 1.10 L/ha	See trifluralin instructions for incorporation and other details and metribuzin instructions for details. This tank mix will not control ANNUAL NIGHTSHADE. Do not use on Ace, Maple Amber, Nattawa, Baron, Apache or Maple Ridge soybean varieties. Note: Maximum registered Lexone 75 DF rate is 0.64 kg product/ha (0.48 kg active/ha).

1 SENCOR 75 DF may be used alternatively.
2 LEXONE (480 g/L) may be used alternatively.
3 TRIFLUREX 40 EC is an alternative product.

Preemergence

NOTE: Apply all treatments in 150 to 300 L water per hectare. Rainfall at 1.5 to 2 cm/ha within 7 to 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. Lower rates are for sandy soils, higher rates for clay or clay loam soils and rates intermediate to these for loam soils.

Germinating annual broadleaf weeds and annual grasses	chloramben AMIBEN (10 Gr)	2.250 to 3.360 kg/ha 22.50 to 33.60 kg/ha	Mustards and cocklebur escape chloramben. Crop safety is excellent. Excessive rainfall may leach out the herbicide. Approximately 6 to 8 weeks control can be expected.
Germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L)	0.100 kg/ha 0.42 L/ha	Refer to label for specific weeds controlled. Heavy infestations of ragweed or barnyard grass may require a tank mix (see below). Can be used on all soil types and soybean varieties. Some rotational cropping restrictions apply (see "Notes on Chemicals").
Germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L) plus linuron LOROX DF (50 DF) or AFOLAN F (480 g/L)	0.100 kg/ha 0.42 L/ha 0.850 to 1.150 kg/ha 1.70 to 2.30 kg/ha 1.77 to 2.39 L/ha	See imazethapyr and linuron instructions for details.
	imazethapyr PURSUIT (240 g/L) plus metribuzin LEXONE DF (75 DF) or plus metribuzin SENCOR 500 F (500 g/L)	0.100 kg/ha 0.42 L/ha 0.400 to 0.480 kg/ha 0.53 to 0.64 kg/ha 0.400 to 0.850 kg/ha 0.80 to 1.70 L/ha	See imazethapyr and metribuzin instructions for details. NOTE: Maximum rate for LEXONE 75 DF is 0.64 kg product/ha 0.48 kg active/ha). Note susceptible varieties above.

Germinating annual broadleaf weeds, some annual grasses including some triazine resistant annual broadleaf weed species	linuron AFOLAN F (480 g/L)[3] or linuron LOROX DF (50 DF)	0.860 to 2.250 kg/ha 1.79 to 4.68 L/ha 1.130 to 2.250 kg/ha 2.26 to 4.50 kg/ha	Annual grasses, ragweed and velvetleaf are partially controlled but are the first to escape treatment, particularly if lower rates of herbicide are used. Do not use on sands (less than 2% to 3% organic matter, see label). Seed beans at least 4 cm deep. Heavy rainfall and adverse weather conditions may result in temporary crop injury. Use higher rate for muck soils and clay soils. Note: Low rate of Lorox 50 DF of 2.25 kg product/ha is equivalent to 1.1 kg active/ha (registered) rather than 0.86 kg active/ha.
	metobromuron PATORAN (50 WP) PATORAN FL (400 g/L)	1.000 to 2.250 kg/ha 2.00 to 4.50 kg/ha 2.50 to 5.63 L/ha	See notes for linuron (above) since they apply to metobromuron. Weed control in muck soils requires a 50% increase in the rate of metobromuron to provide acceptable weed control. The lowest rate of Patoran equivalent to 1.0 kg/ha metobromuron will only control certain annual broadleaf weeds and may require inter-row cultivation where possible.
	monolinuron AFESIN (200 g/L)	1.700 to 1.950 kg/ha 8.50 to 9.75 L/ha	Do not use on sandy soils (3% organic matter or less). Beans should be seeded at least 4 cm deep. Annual grasses, ragweed and velvetleaf are partially controlled but are the first weeds to escape treatment, particularly at lower herbicide rates. Heavy rainfall and adverse weather conditions may result in crop injury, which is usually of a temporary nature.
Germinating annual grasses and annual nightshade	metolachlor DUAL (960 g/L)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha	Lasts 10 to 14 weeks in the soil. Effective on a wide range of soil types. Do not use on muck, peat or high organic matter soils. To control broadleaf weeds which may escape metolachlor, tank mix with broadleaf weed herbicides (see below).
Germinating annual broadleaf weeds and grasses including velvetleaf, but not nightshade	metribuzin LEXONE DF (75 DF) or metribuzin SENCOR 500 F (500 g/L)	0.480 to 1.130 kg/ha 0.64 to 1.50 kg/ha 0.425 to 1.125 kg/ha 0.85 to 2.25 L/ha	Do not use on sandy soils (2% organic matter or less). Annual nightshade is not controlled. Velvetleaf, cocklebur and jimsonweed control is usually satisfactory. Barnyard grass is only partially controlled. Use the recommended rate for each soil types (see label), otherwise crop injury may occur. Excessive rainfall and adverse weather conditions may result in crop injury. Do not use on Ace, Maple Amber, Nattawa, Baron, Apache and Maple Ridge varieties.
Germinating annual grasses and annual broadleaf weeds including nightshade and some triazine resistant annual broadleaf weeds	metolachlor DUAL (960 g/L) plus linuron LOROX DF (50 DF) AFOLAN F (480 g/L)[4]	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 0.850 to 1.150 kg/ha 1.70 to 2.30 kg/ha 1.77 to 2.39 L/ha	See metolachlor and linuron instructions for details
Germinating annual broadleaf weeds and grasses including velvetleaf, nightshade and triazine resistant redroot pigweed and lamb's-quarters	metolachlor DUAL (960 g/L) plus metribuzin LEXONE DF (75 DF) plus linuron LOROX DF (50 DF) LOROX L (480 g/L)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 0.160 to 0.410 kg/ha 0.21 to 0.55 kg/ha 0.750 to 1.000 kg/ha 1.50 to 2.00 kg/ha 1.56 to 2.08 L/ha	See metolachlor, linuron and metribuzin instructions for details.
Germinating annual grasses and annual broadleaf weeds including nightshade and triazine resistant annual broadleaf weeds	metolachlor DUAL (960 g/L) metobromuron PATORAN FL (400 g/L) PATORAN (50 WP)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 1.200 to 1.700 kg/ha 3.00 to 4.25 L/ha 2.40 to 3.40 kg/ha	See metolachlor and metobromuron for details.

Germinating annual grasses and annual broadleaf weeds including nightshade	metolachlor DUAL (960 g/L) plus metribuzin LEXONE DF (75 DF)[1] SENCOR 500 F (500 g/L)[2]	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 0.420 to 0.850 kg/ha 0.53 to 0.96 kg/ha 0.84 to 1.70 L/ha	See metolachlor and metribuzin for details. Note: Maximum registered rate for Lexone 75 DF is 0.96 kg product/ha (0.72 kg active/ha).
Germinating annual grasses and annual broadleaf weeds including nightshade and some triazine resistant annual broadleaf weeds	metolachlor DUAL (960 g/L) plus monolinuron AFESIN (200 g/L)	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 1.100 to 1.700 kg/ha 5.50 to 8.50 L/ha	See metolachlor and monolinuron for details.
Germinating annual broadleaf weeds and grasses including velvetleaf, nightshade and some triazine resistant annual broadleaf weeds species	metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG) plus linuron[3] AFOLAN F (480 g/L) LOROX DF (50 DF)	0.350 to 0.750 kg/ha 0.70 to 1.50 L/ha 0.47 to 1.00 kg/ha 0.500 to 1.200 kg/ha 1.04 to 2.50 L/ha 1.00 to 2.40 kg/ha	See metribuzin and linuron instructions for details.

1 *SENCOR (75 DF) may be used alternatively.*
2 *LEXONE (480 g/L) equivalent label rate is 1.0 to 2.5 L/ha.*
3 *LOROX (480 g/L) equivalent is 2.45 to 5 L/ha for a 1.1 to 2.25 kg active/ha rate. LINURON (400 g/L) equivalent is 2.75 to 5.5 L/ha.*
4 *LOROX (480 g/L) equivalent rate is 1.8 to 2.25 L/ha.*

Split Application

NOTE: Preplant incorporated herbicide treatments followed by preemergence or postemergence treatments offer many split applications or sequential combinations or programs. Similarly, preemergence treatments may be followed by postemergence herbicides for broad spectrum weed control. The combination of a herbicide whose strength is controlling annual grasses with a herbicide whose strength is mainly broadleaf weed control is recommended. Three-quarters of the full rate to the full rate of each substance is recommended, depending on soil type and weed infestation. For sequential or split applications use one herbicide from the left hand column for annual grass control, and combine or program it with one of the herbicides from the right hand column for annual broadleaf control. Do not tank mix any of the products or formulations that are not registered in combination.

Herbicides Controlling Most Annual Grasses	Applied	Herbicides Controlling Most Annual Broadleaf Weeds	Applied
trifluralin(TREFLAN,RIVAL,TRIFLUREX	ppi	linuron(AFOLAN,LOROX)	pre
metolachlor(DUAL)	ppi,pre	metobromuron(PATORAN)	pre
diclofop-methyl(HOE-GRASS 284)	post	chloramben(AMIBEN)	pre
ethalfluralin(EDGE)	ppi	imazethapyr(PURSUIT)	post
venolate(VERNAM)	ppi	metribuzin(LEXONE,SENCOR)	pre,ppi
fenoxaprop-ethyl(EXCEL)	post	bentazon(BASAGRAN)	post
fluazifop-butyl(FUSILADE)	post	thifensulfuron+bentazon(PINNACLE+BASAGRAN)	post
quizalofop-ethyl(ASSURE)	post	thifensulfuron(PINNACLE)	post
sethoxydim(POAST)	post		

Postemergence

Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle and some suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus oil concentrate ASSIST oil concentrate	0.840 to 1.080 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	Apply when soybeans are in unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled. Top growth of Canada thistle and yellow nutsdedge is controlled and field bindweed may be suppressed by 2 applications of BASAGRAN at 1.75 L/ha (0.84kg active/ha) 10 days apart may be required. A new flush of weeds may emerge after the first flush has been controlled. Temporary crop injury may occur under abnormally cool or hot, humid conditions. Reduce rate of oil concentrate to 1 L/ha when those conditions occur. Cool weather or drought may delay control. For improved and more consistent control of velvetleaf and lamb's-quarters, 10 L/ha or 28% urea ammonium nitrate (UAN) or 6 L/ha of liquid ammonium sulphate may be added. The addition of either nitrogen source may cause slight leaf burn, but new growth is normal and crop vigour is not reduced.
Emerged annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L)	0.100 kg/ha 0.42 L/ha	A non-ionic surfactant at 0.25% v/v and liquid fertilizer (28-0-0, 10-34-0, 32-0-0) at 2 L/ha must be added to the spray solutions. Apply when the weeds are up to the 2 true leaf stage. Imazethapyr will provide residual weed control from soil activity. Some rotational cropping restrictions apply (see "Notes on Chemicals").
Redroot pigweed, lamb's-quarters, velvetleaf, lady's-thumb and wild mustard	thifensulfuron- methyl PINNACLE (75 DF) plus surfactant AGRAL 90, CITOWETT or AGSURF	0.004 to 0.006 kg/ha 0.0053 to 0.0080 L/ha	Apply to emerged weeds up to 10 cm in height when soybeans have the first trifoliate leaf fully expanded. The higher rate should be used for lamb's-quarters and velvetleaf. The addition of UAN (28-0-0) at 4% V/V will enhance the control of velvetleaf.NOTE: Add one of the surfactants at 1 L per 1000 L spray solution. Also note that .0055 to .008 kg of Pinnacle per hectare is the same as 5.5 to 8 grams per hectare.
Emerged annual broadleaf weeds	thifensulfuron- methyl PINNACLE (75 DF) plus bentazon BASAGRAN (480 g/L) plus oil concentrate ASSIST oil concentrate	0.006 kg/ha 0.011 kg/ha 0.840 to 1.105 kg/ha 1.75 to 2.30 L/ha 2.000 L/ha	Apply to emerged weeds when soybeans have the first trifoliate leaf fully expanded. If Canada thistle, yellow nutsedge and field bindweed are target species a second application of BASAGRAN alone may be required. See BASAGRAN section for remarks. UAN (28-0-0) should not be added to this tankmix. Also note that trifensulfuron-methyl at .006 kg per hectare is the same as 6 grams per hectare. Pinnacle at .008 kg per hectare is the same as 8 grams per hectare.
Emerged annual grasses including green and yellow foxtail, barnyard grass, old witch grass, fall panicum, wild oats, and volunteer corn but not crabgrass	diclofop-methyl HOE-GRASS 284 (284 g/L)	1.000 kg/ha 3.52 L/ha	Apply when annual grasses are in the 1 to 4 leaf stage (2 to 3 leaf stage is optimum). Do not mix with other postemergence herbicides because diclofop-methyl is inactivated. Other postemergence herbicides must be applied at least 4 days before or after diclofop-methyl application.
Emerged annual grass and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.122 kg/ha 1.36 L/ha	Apply to emerged grasses in the 1 to 6 leaf stage which are actively growing while crop is small enough to permit thorough coverage. A second application may be necessary to control grasses emerged after the first treatment.

Emerged annual grass and broadleaf weeds	fenoxaprop-ethyl EXCEL (90 g/L) plus bentazon BASAGRAN (480 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.122 kg/ha 1.36 L/ha 0.840 to 1.100 kg/ha 1.75 to 2.29 L/ha 2.000 L/ha 1.000 L/ha	Mix EXCEL with BASAGRAN for the control of annual grass and broadleaf weeds. For more specific details regarding the broadleaf weed control consults the "Notes on Chemicals" section. If annual broadleaf and grassy weeds are not in the correct stage for a tank mix application, use a split application at the correct stage for each product. Use ASSIST at 1 L/ha when hot and humid.
Emerged annual grasses, wild oats, proso millet, volunteer corn, wheat and barley, Johnson grass, quackgrass and wirestem muhly	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Apply at 0.6 to 1 L/ha at 2 to 5 leaf stage of annual grasses. Apply at 1 to 2 L/ha at 3 to 5 leaf stage of quackgrass and wirestem muhly. Quackgrass top growth is suppresses at 1 L/ha. Thorough preplant tillage, fragmenting quackgrass rhizomes, improves control. Inter-row cultivation should not occur until 5 days after application. Do not tank mix with postemergence broadleaf weed herbicide. Apply other postemergence herbicides separately at least 3 days after fluazifop-butyl. Add 1 litre AGRAL 90 per 1000 litres spray solution.
Barnyard grass, green foxtail, wild oats, volunteer wheat, volunteer barley and quackgrass	quizalofop-ethyl ASSURE (96 g/L) plus oil concentrate Canplus 411	0.096 to 0.148 kg/ha 1.00 to 1.54 L/ha	Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and quackgrass in the 2 to 6 leaf stage. Use the higher rate for control of quackgrass. Use the higher rate of Canplus when wild oats and quackgrass are the target weeds or under drought conditions. Do not apply to soybeans within 80 days of harvest. Add Canplus 411 at 5 to 10 L per 1000 L spray solution.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/ha 0.81 to 1.63 L/ha 2.000 L/ha 1.000 L/ha	Soybeans are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. Water rates of 100 to 200 L per hectare provide the best results.
Quackgrass and annual grasses	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will result in more uniform quackgrass emergence. Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L water per hectare. Crop competition and inter-row cultivation 7 to 14 days after application will assist in quackgrass control for 6 to 8 weeks.
	sethoxydim POAST (184 g/L) plus ammonium sulphate BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 2.000 kg/ha 4.08 L/ha 2.000 L/ha 1.000 to 2.000 L/ha	See above remarks. Note: Do not tank mix sethoxydim with other postemergence herbicides because sethoxydim is inactivated. Other postemergence herbicides such as bentazon must be applied at least 4 days before or after sethoxydim is applied.

Harvest-Aid

Harvest-Aid to burn off weeds	diquat REGLONE (200 g/L) plus surfactant AGRAL 90	0.420 to 0.550 kg/ha 2.10 to 2.75 L/ha	Apply in 300 L/ha water to burn off weeds when 80 to 90% natural crop leaf defoliation has occurred. Beware of drift to adjacent crops or plants.AGRAL 90 to be applied 1 litre to 1000 litres spray solution

Spot Treatment

Spot treatment control of emerged Canada thistle and quackgrass	glyphosate* ROUNDUP (356 g/L)	1.700 to 2.500 kg/ha 4.78 to 7.03 L/ha	Apply as a spot treatment when quackgrass has more than 3 to 4 leaves per stem and dogbane, milkweed, bindweed, or thistles are at bud to flower stage. The crop will be killed in the sprayed area. Rainfall should not occur within 6 hours after application or weed control will be reduced. Applications may be made up to pod set but not after seed set.
Spot treatment control of milkweed, field bindweed and dogbane	glyphosate* ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	

* *LAREDO (356 g/L) and WRANGLER (356 g/L) are alternate products for glyphosate.*

Table 4. Soybean Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E -Excellent G - Good F - Fair P - Poor

			ANNUAL BROADLEAVES										ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	cocklebur	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	triazine tolerant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
amitrole	AMITROL-T	preplant or post harvest	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	2	**	**	2	G	2	2	G
glyphosate	LOREDO, ROUNDUP or WRANGLER	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**		P	E	**	E	**	**	E
glyphosate	LOREDO, ROUNDUP or WRANGLER	spot treat or after harvest	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	E	P	E	P	E	E	E	P
imazethapyr	PURSUIT	preplant soil appl. emerged weeds	 E	 E	E	G F	E E	G E	E E	G E	E E	G E	G G	 F		E E	E E	 G					P P			G

Table 4. Soybean Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES										ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	cocklebur	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	triazine tolerant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
imazethapyr + glyphosate	PURSUIT + ROUNDUP	preplant	E	E		F	E	E	E	E	E	E	G	F		E	E	G					E			G
imazethapyr + paraquat	PURSUIT + GRAMOXONE	preplant	E	E		F	E	E	E	E	E	E	G	F		E	E	G					P			G
ethalfluralin	EDGE	preplant incorporated	E	P	F	G	P	F	G	P	G	P	E	E	E	E	E	G	F	P	P	P	P	P	P	G
ethalfluralin + metribuzin	EDGE + LEXONE or SENCOR	preplant incorporated	E	G	E	E	E	F	E	E	G	E	E	E	E	E	E	G	F	P	P	P	P	P	P	G
metolachlor	DUAL	preplant incorporated	P	P	P	P	P	G	P	P	P	P	E	E	G	E	E	F	P	P	P	G	P	P	P	G
trifluralin	TREFLAN, RIVAL, TRIFLUREX	preplant incorporated	F	P	P	G	P	P	G	P	G	P	E	E	E	E	E	F	P	P	P	P	P	P	P	E
metolachlor + metribuzin	DUAL + LEXONE or SENCOR	preplant incorporated	G	G	E	E	E	G	E	E	P	E	E	E	G	E	E	F	P	P	P	G	P	P	P	G
trifluralin + metribuzin	TREFLAN or TRIFLUREX or RIVAL + SENCOR or LEXONE	preplant incorporated	E	G	E	E	E	P	E	G	G	E	E	E	E	E	E	F	P	P	P	F	P	P	F	G
vernolate	VERNAM	preplant incorporated	F	P	F	F	P	P	F	F	P	P	G	E	G	E	G	F	P	F	P	F	P	P	P	G
chloramben	AMIBEN Gr	Preemergence	E	P	E	E	P	F	E	G	G	F	G	G	F	G	G	P	P	P	P	P	P	P	P	E
imazethapyr	PURSUIT	Preemergence			E	E	E	E	E	G	E	E	G			E	E	G					P			G
imazethapyr + linuron	PURSUIT + LOROX or AFOLAN	Preemergence	E		E	E	E	E	E	E	E	E	E			E	E	G					P			G
imazethapyr + metribuzin	PURSUIT + LEXONE or SENCOR	Preemergence	E	G	E	E	E	E	E	E	E	E	E	G	G	E	E	E					P			G

Table 4. Soybean Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent F - Fair
G - Good P - Poor

			ANNUAL BROADLEAVES										ANNUAL GRASSES						PERENNIALS							
Treatment	Trade Name	Method of Application	buckwheat, wild	cocklebur	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	triazine tolerant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
linuron	AFOLAN, LOROX	Preemergence	E	P	E	E	E	G	E	G	E	F	F	F	F	F	F	P	P	P	P	P	P	P	P	G
monolinuron	AFESIN	Preemergence	E	P	E	E	E	G	E	G	E	F	F	F	F	F	F	P	P	P	P	P	P	P	P	G
metobromuron	PATORAN	Preemergence	E	P	E	E	E	G	E	G	E	F	F	F	F	F	P	P	P	P	P	P	P	P	P	G
metribuzin	LEXONE, SENCOR	Preemergence	G	G	E	E	E	P	E	E	P	E	G	G	G	G	G	P	P	P	P	P	P	P	P	G
metolachlor	DUAL	Preemergence	P	P	P	P	P	E	P	P	P	P	E	E	G	E	E	F	P	P	P	P	P	P	P	G
metolachlor + metribuzin + linuron	DUAL + LEXONE + LOROX	Preemergence	E	F	E	E	E	E	E	E	E	G	E	E	G	E	E	F	P	P	P	P	P	P	P	G
metribuzin + linuron	SENCOR + AFOLAN or LOROX	Preemergence	E	F	E	E	E	G	E	E	E	E	G	G	G	G	G	P	P	P	P	P	P	P	P	G
metolachlor + linuron	DUAL + AFOLAN, LOROX	Preemergence	E	P	E	E	E	E	E	G	E	F	E	E	G	E	E	F	P	P	P	P	P	P	P	G
metolachlor + metobromuron	DUAL + PATORAN	Preemergence	E	P	E	E	E	E	E	G	E	F	E	E	G	E	E	F	P	P	P	P	P	P	P	G
metolachlor + metribuzin	DUAL + LEXONE, SENCOR	preemergence	G	G	E	E	E	E	E	E	P	E	E	E	G	E	E	F	P	P	P	P	P	P	P	G
metolachlor + monolinuron	DUAL + AFESIN	preemergence	E	P	E	E	E	G	E	G	E	F	E	E	G	E	E	F	P	P	P	P	P	P	P	G
bentazon	BASAGRAN	postemergence	F	E	E	G	E	F	F	E	E	E	P	P	P	P	P	P	F[1]	P	P	G[1]	P	G[1]	G[1]	G
diclofop-methyl	HOE-GRASS	postemergence	P	P	P	P	P	P	P	P	P	P	E	F	E	E	E	P	P	P	P	P	P	P	P	E
fenoxaprop-ethyl	EXCEL	postemergence	P	P	P	P	P	P	P	P	P	P	E	E	E	E	E	E	P	P	P	P	P	P	P	E
fenoxaprop-ethyl + bentazon	EXCEL + BASAGRAN	postemergence	F	E	E	G	E	F	F	E	E	E	E	E	E	E	E	E	G	P	P	G[1]	P	G[1]	G[1]	G

Table 4. Soybean Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E -Excellent G - Good		F - Fair P - Poor	ANNUAL BROADLEAVES										ANNUAL GRASSES						PERENNIALS							
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	cocklebur	lady's-thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed	triazine tolerant	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	CROP TOLERANCE
fluazifop-butyl	FUSILADE	postemergence	P	P	P	P	P	P	P	P	P	P	E	E	E	G	E	G	P	P	P	P	G	P	P	E
imazethapyr	PURSUIT	postemergence	E	E		G	E	E	E	E	E	E	E	G		E	E	G					P			G
quizalofop-ethyl	ASSURE	postemergence	P	P	P	P	P	P	P	P	P	P	E			E			P	P	P	P	E	P	P	G
thifensulfuron-methyl	PINNACLE	postemergence		F	E	E	E	P	E	P	E	E	P	P	P	P	P	P	P	P	P	P	P	P	P	G
thifensulfuron-methyl + bentazon	PINNACLE + BASAGRAN	postemergence	F	E	E	E	E	F	E	E	E	E	P	P	P	P	P	P	F[1]	P	P	G[1]	P	G[1]	G[1]	G
sethoxydim	POAST	postemergence	P	P	P	P	P	P	P	P	P	P	E	E	E	E	E	E	P	P	P	P	F	P	P	E

*** Indicates that annual weed will be controlled if emerged, and the perennials can be controlled if treated at the optimum time, which is usally not the same as for quackgrass.*

[1] Good control of these perennial weed may require two applications of BENTAZON + ASSIST oil concentrate about 7 to 10 days apart.

[2] Optimum growth stages for best control of these weeds will not likely be attained prior to planting soybeans. See further details on label.

SUNFLOWERS

Cultural control of weeds in sunflowers can be used successfully, but only if weeds are also controlled in other crops in the rotation. There are several tillage options in the sunflower crop.

Preplant tillage can control one or two flushes of early germinating weeds. Plant sunflowers immediately after the last tillage operation.

A rotary hoe set to cultivate shallow can be effective in removing annual weeds which are just emerging. It is not very useful for controlling well rooted seedlings.

Spring tooth harrows can be used to control small weeds when sunflowers are in the 4 to 6 leaf stage. There will be some damage to sunflowers and larger weeds will not be well controlled.

One or two cultivations with a row crop cultivator is the most common form of cultural control. Sunflowers have to be big enough to withstand burial. Lateral roots on sunflowers are shallow, so avoid cultivating too deep or too close to plants.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	Apply in 100-300 L/ha of water in the previous fall or in the spring when quackgrass is actively growing with at least 4 new leaves on each emerged shoot. A minimum of 2 seasons control is obtained at these rates.
	glyphosate ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

* *Additional formulations are available. See Table 1.*

Preplant Incorporated

NOTE: Apply all treatments in a minimum of 100 L of water per hectare. Some herbicides may also be impregnated on dry bulk fertilizer - check the label for procedures. Lower rates are for sandy to sandy loam soils, higher rates for clay to clay loam soils. Two incorporations in different directions using a tandem disc or field cultivator are required. Consult the label for recommended speed and operating depth for different equipment and herbicides.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS
Germinating annual grasses and some broadleafs	EPTC EPTAM (800 g/L)	3.400 kg/ha 4.25 L/ha	Do not use on light sandy soils with less than 3% organic matter. Incorporate immediately to prevent loss.
Germinating annual grasses, lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 1.150 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.30 L/ha	Incorporate in the spraying operation if possible, but not more than 24 hours after application. The second incorporation can be anytime before planting.
Postemergence			
Emerged quackgrass; emerged annual grasses including proso millet, wild oats; volunteer corn and spring cereals	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	For quackgrass, use the 2.0 L/ha rate. See label for rates to control various annual grasses. Allow 120 days between application and sunflower harvest.AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
Wild oats	flamprop-methyl MATAVAN (84 g/L)	0.420 to 0.550 kg/ha 5.00 to 6.55 L/ha	Apply when wild oats are in the 3 to 6 leaf stage, with the majority in the 3 to 4 leaf stage. Apply before sunflowers form a canopy.

Harvest-Aid

Harvest-Aid to reduce time to harvest	diquat REGLONE (200 g/L) plus surfactant AGRAL 90	0.300 kg/ha 1.50 L/ha	Diquat may be used to reduce the period of time from maturity to harvest, to speed up harvesting, and decrease seed moisture at harvest. Apply in 45 L of water per hectare with fixed wing aircraft. Spray when seeds reach maturity (20% to 50% seed moisture). Combine 15 to 20 days after spraying. Beware of drift to adjacent crops or plants. See "Notes on Chemicals" for comments on aerial application. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

Table 5. Sunflower Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated, or may cause crop injury or may cause crop injury.

Rating: E -Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES									ANNUAL GRASSES							PERENNIALS					
Treatment	**Trade Name**	**Method of Application**	cocklebur	lamb's-quarter	mustards	nightshades	pigweeds	ragweed	smartweed	velvetleaf	wild buckwheat	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	proso millet	wild oats	field bindweed	horsetail	milkweed	nutsedge	quackgrass	thistle, Canada
glyphosate	ROUNDUP or LOREDO or WRANGLER	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	P	**	P	E	**
EPTC	EPTAM	ppi	P	G	P	G	F	F	F	P	P	E	E	G	E	E	F	G	P	F	P	G	F	P
trifluralin	TREFLAN or RIVAL	ppi	P	G	P	P	G	P	P	P	P	E	E	G	E	E	F	F	P	P	P	P	P	P
fluazifop-butyl	FUSILADE	post	P	P	P	P	P	P	P	P	P	E	E	E	E	E	G	G	P	P	P	P	G	P
flamprop-methyl	MATAVEN	post	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	E	P	P	P	P	P	P

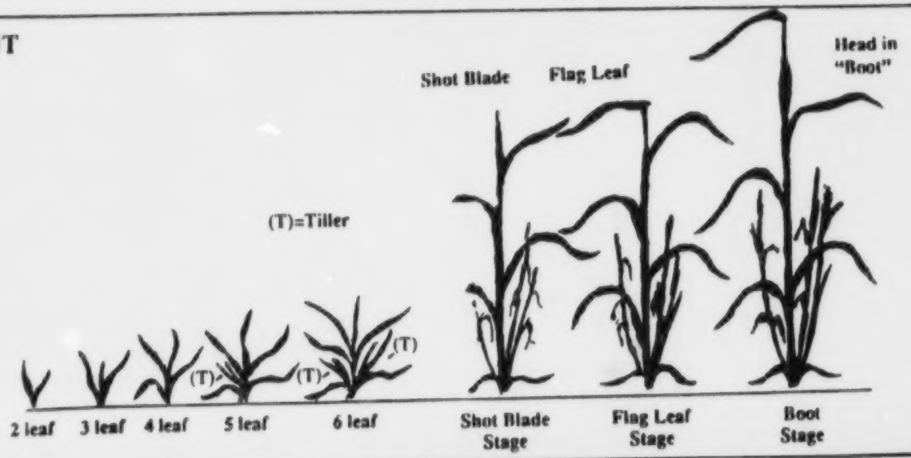
** *Indicates that annual weeds will be controlled only if emerged. Perennial weeds can be controlled if treated at the optimum stage, which is usually not possible with the sunflower crop.*

TOBACCO (FLUE-CURED AND BURLEY)

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	Apply to actively growing quackgrass with at least 3 to 4 new leaves per emerged shoot in 100 to 300 L of water per hectare in the previous fall or in the spring before the crop is planted. A minimum of 2 seasons control is obtained in these rates.
	glyphosate* ROUNDUP (356 g/L)	0.836 to 0.890 kg/ha 2.35 to 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50-100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.
Preplant Incorporated			
Germinating annual weeds and horsetail	pebulate TILLAM (720 g/L)	4.530 to 5.540 kg/ha 6.30 to 7.70 L/ha	Pebulate should be applied to a dry soil surface and incorporated within 10 minutes. Delay transplanting for 4 days after application. Use the low rate on sandy soil and high rate on loamy sands. It can also be applied at the higher rate prior to row fumigation.
Post Transplant			
NOTE: Apply in 150 to 300 L water per hectare			
Germinating annual weeds	napropamide DEVRINOL 50W (50 WP)	1.125 to 2.250 kg/ha 2.25 to 4.50 kg/ha	Apply immediately following transplanting in a 25 to 30 cm band over the transplants. Use lower rates on lighter soils. For best results, lightly incorporate or apply irrigation if rainfall does not occur within 2 days of application. After harvest, soil should be worked at right angles to the rows to prevent injury to succeeding crops. Small grains may be seeded in the fall to prevent soil erosion. These grains may be stunted but not otherwise affected.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	May be applied up to 45 days to harvest.AGRAL 90 applied 1 litre in 1000 litres spray solution.

* *Additional glyphosate products are available. See Table 1.*

STAGES OF CEREAL DEVELOPMENT



WHEAT (SPRING), OATS AND BARLEY NOT UNDERSEEDED TO FORAGE CROPS

Crop rotation is a valuable technique used to prevent the build up of weed populations associated with small grain production. Wild oats can increase in population and severely limit production on fields where small grains are grown continuously. Some weeds (e.g., proso millet) will be well controlled by cereal competition.

Blind harrowing with a light harrow, before emergence of cereals, can help to control small germinating weeds. A light harrow can also be used in cereals up to the 3 leaf stage, or a weeder harrow (L shaped flexible tines) at the 4 leaf stage to provide better control of small annual broadleaf weeds. The timing of these harrowing operations is critical. The weeds must be small and the soil surface must be dry and easily worked.

Weeds must be emerged from the soil surface and in early stages of growth to be killed by the rates of the herbicides used on cereal grains. Weeds which are growing during early periods of cereal growth (up to 5 leaf stage) have the greatest effect on the cereal yield.

Cereals are usually quite resistant to injury from 2,4-D, MCPA, 2,4-DB and MCPB. The growth stage for maximum safety varies with the cereal and the herbicide. Check the label for appropriate timing. When counting the leaves on cereal plants, some confusion can occur if tiller leaves are present. These leaves are not counted. The above diagram may be useful when determining the cereal leaf stages referred to in the publication.

Cereal grains have an advantage in that they do not make use of the full growing season. This is particularly true of the winter cereals where preplant cultivation and postharvest cultivation can be used to stimulate germination of weed seeds and reduce perennial weed populations.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant and Post Harvest			
NOTE: Apply all treatments in 100 to 200 L water per hectare except where otherwise noted.			
Emerged quackgrass	amitrole AMITROL-T (200 g/L)	4.400 to 5.000 kg/ha 22.00 to 25.00 L/ha	Apply after harvest when regrowth is 15-20 cm tall. Plow when the quackgrass becomes white or purple, about 2 weeks after treatment. Do not apply after Oct. 1.
	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	A minimum of two seasons control. Apply in the fall or spring before planting in 100-300 L/ha of water when the quackgrass is actively growing with at least 3 to

			4 new leaves on each emerged shoot. Spring application may delay planting and thereby reduce grain yield. (Important: see "Notes on Chemicals" section for more information.)
	glyphosate* ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	A minimum of one season control. Apply in the fall or spring before planting in 50-100 L/ha of water when the quackgrass is actively growing with at least 3 to 4 new leaves on each emerged shoot. Spring application may delay planting and thereby reduce grain yield. use flat-fan nozzle tips.For use in higher water volumes, the addition of a surfactant, Enhance or Frigate, is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.
After harvest treatment to regrowth of Canada thistle, field bindweed and other perennial broadleaf weeds	glyphosate* ROUNDUP (356 g/L)	3.238 kg/ha 9.10 L/ha	Apply to actively growing weed foliage. Wait at least 5 days after application before working the area.
	dicamba BANVEL 480 (480 g/L)	1.202 kg/ha 2.50 L/ha	Apply to actively growing weed foliage at least 2 weeks before a killing frost. Wait at least 3 weeks after application before working the area. Plant only cereals, soybeans or field corn in the year after application.
	2,4-D/ dicamba/ mecoprop KILMOR (485 g/L)	0.534 to 0.850 kg/ha 1.10 to 1.75 L/ha	Apply to actively growing weed foliage. Wait at least 5 days after application before working the area.
Emerged Canada thistle and perennial sow-thistle	amitrole AMITROL-T (200 g/L)	4.400 to 5.000 kg/ha 22.00 to 25.00 L/ha	Apply after harvest to emerged actively growing weeds. Wait 10 to 14 days after spraying before working the area.

* *Additional glyphosate products are available. See Table 1.*

Postemergence

NOTE: Apply all treatments in 100-200 L water per hectare except where otherwise noted.

Broadleaf weeds such as mustards, lamb's-quarters, ragweed, pigweed	2,4-D* 2,4-D (500 g/L)	0.350 to 0.850 kg/ha 0.70 to 1.70 L/ha	Apply when the crop is in the 3 to 5 leaf stage of growth. Do not use on Mingo barley. On oats, do not apply more than 0.50 kg/ha (active) or 1 L/ha (500 g/L) product.
Broadleaf weeds such as hempnettle, mustards, lamb's-quarters, ragweed, pigweed	MCPA* ESTAMINE MCPA (500 g/L)	0.350 to 0.850 kg/ha 0.70 to 1.70 L/ha	Apply when the crop is in the 2 to 5 leaf stage of growth. For hempnettle control, use the high rate of MCPA. The potassium salt formulation of MCPA is most effective on hempnettle.
Many broadleaf weeds including mustards, lady's-thumb, field bindweed, Canada thistle and perennial sow-thistle	2,4-D/ dicamba/ mecoprop KILMOR (485 g/L)	0.413 to 0.534 kg/ha 0.85 to 1.10 L/ha	For barley, use only the lower rate and apply when the crop is in the 2 to 3 leaf stage. For wheat and oats apply when the crop is in the 3 to 4 leaf stage. The higher rate is required for control of Canada thistle and field bindweed.
	dicamba/ MCPA/ mecoprop TARGET (400 g/L)	0.400 to 0.600 kg/ha 1.00 to 1.50 L/ha	Use when wheat or oats are in the 2 to 5 leaf stage or barley in the 2 to 4 leaf stage. Apply when weeds are in the 2 to 3 leaf stage. Use the high rate if weeds are beyond the 3 leaf stage.

Many broadleaf weeds including wild buckwheat, corn spurry, green smartweed, lady's-thumb, field bindweed, Canada thistle and perennial sow-thistle	2,4-D* 2,4-D (500 g/L) or MCPA* ESTAMINE MCPA (500 g/L) plus dicamba BANVEL 480 (480 g/L)	0.280 to 0.420 kg/ha 0.56 to 0.84 L/ha 0.280 to 0.420 kg/ha 0.56 to 0.84 L/ha 0.110 to 0.140 kg/ha 0.23 to 0.29 L/ha	The 2,4-D or MCPA should be included if mustards are present. Use only the lower rate on barley. Apply to wheat, barley and oats when they are in the 2 to 5 leaf stage. Do not use dicamba + 2,4-D on oats.
	dicamba/ MCPA (1:4) DYVEL ((1:4) 420 g/L)	0.525 kg/ha 1.25 L/ha	Apply when cereals are in the 2 to 5 leaf stage. Hempnettle, corn spurry and cow cockle are controlled best when application is made early in this stage.
Many broadleaf weeds including wild buckwheat	dichlorprop/ 2,4-D DIPHENOPROP (600 G/L) ((1:1) 600 g/L) ESTAPROP ((282:300) 582 g/L)	1.017 kg/ha 1.75 L/ha 1.75 L/ha	For spring wheat and barley only. Apply to emerged weeds when the cereals are in the 4 leaf to early flag leaf stage.
Lady's-thumb, wild buckwheat and many other broadleaf weeds	bromoxynil PARDNER (280 g/L)	0.280 to 0.336 kg/ha 1.00 to 1.20 L/ha	Use the lower rate if weeds are not past the 4 leaf stage. Thorough spray coverage of weed foliage is required for control. Application should be made before the cereals have more than 5 leaves because spray coverage will probably not be adequate beyond this stage.
Lady's-thumb, wild buckwheat, mustards and many other broadleaf weeds	bromoxynil/ MCPA (1:1) BUCTRIL M ((1:1) 560 g/L)	0.560 kg/ha 1.00 L/ha	Apply before the weeds have more than 4 leaves and the cereals are in the 2 to 5 leaf stage because spray coverage will probably not be adequate beyond this stage.
Lady's-thumb, wild buckwheat, mustards, hempnettle and many other broadleaf weeds	bromoxynil PARDNER (280 g/L) plus 2,4-D* 2,4-D (500 g/L) or MCPA* ESTAMINE MCPA (500 g/L)	0.280 kg/ha 1.00 L/ha 0.280 kg/ha 0.56 L/ha 0.280 to 0.550 kg/ha 0.56 to 1.10 L/ha	Include 2,4-D or the lower rate of MCPA in mustards are present. Use the higher rate of MCPA if hempnettle is present. Do not use the 2,4-D mixture on oats and only on barley at the 4 to 5 leaf stage.
Many broadleaf weeds including hempnettle	bromoxynil/ MCPA (1:1)* BUCTRIL M ((1:1) 560 g/L) plus MCPA* ESTAMINE MCPA (500 g/L)	0.560 kg/ha 1.00 L/ha 0.280 kg/ha 0.56 L/ha	Addition of MCPA will improve hempnettle control.
Many broadleaf weeds including lady's-thumb, wild buckwheat, hempnettle, corn spurry and chickweed	cyanazine/ MCPA (1:2) BLAGAL ((1:2) 375 g/L)	0.843 kg/ha 2.25 L/ha	Use when weeds are in the 2 to 4 leaf stage and the crop is in the 2 to 5 leaf stage. May cause temporary yellowing of the lower leaves of the crop plants.
	linuron LOROX DF (50 DF) LOROX L (480 g/L) plus MCPA* MCPA AMINE (500 g/L)	0.210 to 0.275 kg/ha 0.42 to 0.55 kg/ha 0.42 to 0.55 L/ha 0.425 to 0.550 kg/ha 0.85 to 1.10 L/ha	Apply when weeds are in the 1 to 4 leaf stage and cereals are in the 2 to 4 leaf stage. May cause temporary yellowing of the lower leaves of the crop plants.

Many broadleaf weeds, Canada thistle and perennial sow-thistle	2,4-DB* 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.100 to 1.400 kg/ha 2.75 to 3.50 L/ha 1.75 to 2.25 L/ha	Apply 2,4-DB at the 5 leaf to early flag stage of cereals.
	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply MCPB/MCPA from the 2 leaf stage to flag leaf stage of cereals.
Many broadleaf weeds including wild buckwheat, lady's-thumb, green and yellow foxtail	propanil/ MCPA (3.6:1) STAMPEDE CM ((3.6:1) 460 g/L)	1.267 kg/ha 2.75 L/ha	Apply when the cereals are in the 2 to 5 leaf stage and weeds are in the 1 to 4 leaf stage. Propanil/MCPA may cause crop yellowing or leaf tip burn but these effects normally disappear in 10 to 14 days.
Emerged annual grasses, including wild oats in spring wheat and barley. Do not use on tame oats	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.710 to 0.795 kg/ha 2.50 to 2.80 L/ha	Apply when the annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha) must be used to control wild oats in the 4 to 5 leaf stage. Hoe-Grass must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually not later than 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Do not use if rain is expected within 1 hour after application. Bromoxynil (PARDNER) may be tank mixed with HOE-GRASS for control of broadleaf weeds. Consult the label for complete mixing instructions. If other herbicides are used for broadleaf weed control, they should be applied at least 4 days before or after HOE-GRASS.
Emerged green foxtail in spring seeded oats and barley	TCA NATA GRASS KILLER PELLETS (85 SG)	1.059 to 2.331 kg/ha 1.25 to 2.75 kg/ha	Use only the low rate on barley. Apply when the foxtail is in the 1 to 3 leaf stage and the crop is in the 2 to 4 leaf stage. Do not use on cereals seeded less than 7.5 cm deep. May be mixed with BUCTRIL M, MCPA or 2,4-D amine for control of broadleaf weeds.
Wild oats in spring barley and spring wheat. Do not use on tame oats	triallate AVADEX BW (400 g/L)	1.400 to 1.700 kg/ha 3.50 to 4.25 L/ha	For wheat, triallate must be applied after planting and worked into the soil to kill wild oats. For barley, triallate can be applied before or after planting and must be worked into the soil. Consult the label for specific instructions on how to work the herbicide into the soil. Use the higher rate on heavier soils.
Wild oats in barley and spring wheat. Do not use on tame oats	difenzoquat AVENGE 200C (200 g/L)	0.700 to 0.850 kg/ha 3.50 to 4.25 L/ha	Use the lower rate of difenzoquat if the wild oat stand is less than 200 plants per m2. Apply when the wild oats are in the 3 to 5 leaf stage. Do not use when the plants are wet or if rain is expected within 6 hours. For control of many broadleaf weeds, Avenge can be tank mixed with 2,4DB* or bromoxynil (Pardner), bromoxynil/MCPA (Buctril M) or 2,4-D/diclorprop (Estaprop). Consult the labels for complete mixing instructions.
Wild oats in spring wheat	flamprop-methyl MATAVAN (84 g/L)	0.420 kg/ha 5.00 L/ha	Apply when the wild oats are in the 3 to 6 leaf stage, before the wheat has more than 6 leaves. Do not use on Selkirk.
Spot treatments on emerged milkweed, field bindweed, Canada thistle and common tansy	glyphosate ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	Apply when the field bindweed has reached full bloom, Canada thistle, milkweed and common tansy are in the bud to full bloom stage. Emerged cereals will be killed by this treatment. To eliminate the possibility of residues in the crop, apply before the cereals have started to show heads.

* *Additional formulations are available. Use rates that give comparable amounts of active ingredient. See Table 1.*

Table 6. Spring Cereal Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisions based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

		CROP			ANNUAL BROADLEAVES								ANNUAL GRASSES					PERENNIALS		
Treatment	**Trade Name**	oats	spring barley	spring wheat	buckwheat, wild	corn spurry	hempnettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	barnyard grass	foxtail, green	foxtail, yellow	old witchgrass	wild oats	bindweed, field	sow-thistle	thistle, Canada
2,4-D amine	2,4-D*	√	√	√	F	P	P	P	E	E	E	E	P	P	P	P	P	F	G	F
MCPA	MCPA*	√	√	√	P	F	G	P	E	E	E	E	P	P	P	P	P	F	G	G
bromoxynil	PARDNER	√	√	√	E	P	P	E	E	G	G	G	P	P	P	P	P	F	F	F
2,4-DB	2,4-DB*	√	√	√	F	P	P	P	E	F	E	E	P	P	P	P	P	G	E	E
dicamba	Banvel	√	√	√	E	E	F	G	E	F	E	E	P	P	P	P	P	G^1	G^1	G^1
MCPB/MCPA (15:1)	TROPOTOX PLUS	√	√	√	P	P	G	P	E	E	E	G	P	P	P	P	P	G	E	E
dichlorprop/2,4-D	ESTAPROP		√	√	G	P	F	G	E	E	E	E	P	P	P	P	P	F	G	G
dicamba + 2,4-D	BANVEL + 2,4-D*		√	√	E	E	P	G	E	E	E	E	P	P	P	P	P	G^1	G^1	G^1
dicamba + MCPA	BANVEL + MCPA*	√	√	√	E	E	G	G	E	E	E	E	P	P	P	P	P	G^1	G^1	G^1
dicamba/MCPA	DYVEL	√	√	√	E	E	G	G	E	E	E	E	P	P	P	P	P	G^1	G^1	G^1
dicamba/2,4-D/mecoprop	KIL-MOR	√	√	√	E	E	G	G	E	E	E	E	P	P	P	P	P	G^1	G^1	G^2
dicamba/MCPA/mecoprop	TARGET	√	√	√	E	E	G	G	E	E	E	E	P	P	P	P	P	G^1	G^1	G^1
linuron + MCPA	LOROX plus MCPA*	√	√	√	E	E	E	E	E	E	E	E					P			
cyanazine/MCPA	BLAGAL	√	√	√	E	E	E	E	E	E	E	E					P			
propanil/MCPA	STAMPEDE CM	√	√	√	G			G	E	E	E	E		G	G		P			
bromoxynil/MCPA (1:1)	BUCTRIL M	√	√	√	E	P	F	E	E	E	G	E	P	P	P	P	P	F	F	F
bromoxynil + MCPA	PARDNER + MCPA*	√	√	√	E	F	G	E	E	E	E	E	P	P	P	P	P	F	F	F
bromoxynil + 2,4-D	PARDNER + 2,4-D*		√	√	E	P	F	E	E	E	E	E	P	P	P	P	P	F	F	F
bromoxynil/MCPA (1:1) + MCPA	BUCTRIL M + MCPA*	√	√	√	E	F	G	E	E	E	E	E	P	P	P	P	P	F	G	G
bromoxynil/MCPA (1:1) + TCA	BUCTRIL M + NaTa Grass Killer Pellets	√	√		E	P	F	E	E	E	G	E	P	G	F	P	P	F	F	F
bromoxynil/MCPA (1:1) + difenzoquat	BUCTRIL M + AVENGE 200 C		√		E	P	F	E	E	E	G	E	P	P	P	P	E	F	F	F
bromozynil + difenzoquat	PARDNER + AVENGE 200 C		√		E	P	P	E	E	G	G	G	P	P	P	P	E	F	F	F

Table 6. Spring Cereal Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisions based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

		CROP			ANNUAL BROADLEAVES								ANNUAL GRASSES					PERENNIALS		
Treatment	**Trade Name**	oats	spring barley	spring wheat	buckwheat, wild	corn spurry	hempnettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	barnyard grass	foxtail, green	foxtail, yellow	old witchgrass	wild oats	bindweed, field	sow-thistle	thistle, Canada
diclofop-methyl + bromoxynil	HOE-GRASS 284 + PARDNER		√	√	E	P	P	E	E	G	G	G	G	G	G	G	E	F	F	F
TCA	NaTa Grass Killer Pellets	√	√		P	P	P	P	P	P	P	P		G			P	P	P	P
TCA + 2,4-D	NaTa Grass Killer Pellets + 2,4-D	√	√		F	P	P	P	E	E	E	E		G			P	F	G	F
TCA + MCPA	NaTa Grass Killer Pellets + MCPA*	√	√		P	F	G	P	E	E	E	E		G			P	F	G	G
difenzoquat	AVENGE 200 C		√	√	P	P	P	P	P	P	P	P	P	P	P	P	E	P	P	P
triallate	AVADEX BW		√	√	P	P	P	P	P	P	P	P	P	P	P	P	E	P	P	P
diclofop-methyl	HOEGRASS 284		√	√	P	P	P	P	P	P	P	P	G	G	G	G	E	P	P	P
flamprop-methyl	MATAVEN			√	P	P	P	P	P	P	P	P	P	P	P	P	E	P	P	P

* *Various formulations available, see Table 1.*

√ *Can be used on this crop.*

[1] *More complete control can be obtained with treatment of actively growing foliage after harvest.*

WHEAT (SPRING), OATS AND BARLEY UNDERSEEDED TO FORAGE CROPS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Many broadleaf weeds in cereals seeded down to alfalfa, bird's-foot trefoil, alsike or ladino clovers and grasses	2,4-DB 2,4-D BUTYRIC (400 g/L) EMBUTOX 625 (625 g/L)	1.100 to 1.400 kg/ha 2.75 to 3.50 L/ha 1.75 to 2.25 L/ha	Apply in 150 to 200 L water per hectare when the legumes are in the 1 to 4 trifoliate stage. Wild mustard plants are not usually controlled if sprayed when they are beyond the 4 leaf stage. Red clover will be damaged by 2,4-DB.

	2,4-DB COBUTOX (400 g/L) EMBUTOX 625 (625 g/L) plus MCPA* MCPA (500 g/L)	0.800 kg/ha 2.00 L/ha 1.25 L/ha 35.000 g/ha 0.07 L/ha	The addition of MCPA gives better control of common mustard than 2,4-DB alone. Apply in 150 to 200 L water per hectare. Apply when the legumes are in the 1 to 4 leaf stage. (0.07 Litres = 70 ml).
Many broadleaf weeds in cereals seeded down to red; alsike and ladino or white dutch clovers and grasses	MCPB/MCPA (15:1) TROPOTOX PLUS ((15:1) 400 g/L)	1.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply in 150 to 200 L water per hectare when legumes are in the unifoliate to the 4th trifoliate leaf stage.
Common mustard and some other small broadleaf weeds in cereals underseeded to red clover	MCPA METHOXONE SODIUM (300 g/L) MCPA SODIUM SALT 30 (300 g/L)	0.300 to 0.450 kg/ha 1.00 to 1.50 L/ha 1.00 to 1.50 L/ha	Treat at an early stage of development of the clover when it is **covered by a canopy of weeds and crop**. Apply in 180 to 240 L of water/hectare. The lower rate may not kill ragweed.
Many emerged broadleaf weeds in cereals seeded to grasses only	2,4-D* 2,4-D (500 g/L) or MCPA ESTAMINE MCPA (500 g/L)	0.280 to 0.420 kg/ha 0.56 to 0.84 L/ha 0.280 to 0.560 kg/ha 0.56 to 1.12 L/ha	Apply when the forage grasses have at least 2 leaves and cereals are in the 2 to 5 leaf stage.
Emerged annual grasses in wheat, barley underseeded to alfalfa, red or sweet clover. Do not use on tame oats	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.710 to 0.795 kg/ha 2.50 to 2.80 L/ha	Apply when the annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha) musty be used to control wild oats in the 4 to 5 leaf stage. Diclofop-methyl must only be applied in the 1 to 4 leaf stage of barley and prior to tillering (usually not later than 21 days after emergence of the crop). Application beyond the 4 leaf stage or after tillering may result in barley damage. Do not use if rain is expected within 1 hour after application. Apply herbicides for broadleaf weed control at least 4 days before or after diclofop-methyl application.
Emerged wild oats in barley and spring wehat underseeded to forage crops. Do not use on tame oats	difenzoquat AVENGE 200C (200 g/L)	0.700 to 0.850 kg/ha 3.50 to 4.25 L/ha	Apply when the wild oats are in the 3 to 5 leaf stage. Use the lower rate when the wild oat stand is less than 200 plants/m2. For control of many broadleaf weeds, AVENGE 200 C can be tank mixed with 2,4-DB*.
Emerged quackgrass	glyphosate** ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	A minimum of 2 seasons control. Apply in 100-300 L/ha of water when the quackgrass is actively growing with at least 4 new leaves on each emerged shoot. Apply in the previous fall or in the spring before the crop is planted. (Important: see "Notes on Chemicals" section for more information).
	glyphosate** ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	A minimum of one season control. Apply in the previous fall or in the spring before the crop is planted. Apply in 50-100 L/ha of water, when the quackgrass is actively growing with at least 4 new leaves on each emerged shoot. Use flat-fan nozzle tips. For use in higher water volumes, the addition of a surfactant Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

Spot treatment emerged milkweed, field bindweed, Canada thistle and common tansy	glyphosate** ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	Apply when field bindweed has reached full bloom, and other weeds are in the bud to full bloom stage. Emerged crop plants will be killed by this treatment. Do not apply after the cereals ahve started to show heads. Do not harvest forage from the treated areas until the treated plants have turned brown. Apply at least 6 hours before rain.

WHEAT (WINTER) AND FALL RYE UNDERSEEDED TO CLOVERS

NOTE: Apply all treatments in 100 to 200 L water per hectare except where otherwise noted.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Many broadleaf annual and winter annual weeds in wheat and rye underseeded to red, alsike, white and ladino clover	MCPB/MCPA TROPOTOX PLUS ((15:1) 400 g/L)	0.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply in the spring when the cereal crop is in the 2 leaf to flag leaf stage, and the weeds are small and actively growing. Legumes should be in the 1 to 3 trifoliate stage. Use 150 to 200 L/ha of water per hectare.
Many broadleaf annual and winter annual weeds in wheat and rye underseeded to red, alsike, white and ladino clovers	MCPA* METHOXONE SODIUM (300 g/L) or METHOXONE SODIUM SALT	0.300 to 0.450 kg/ha 1.00 to 1.50 L/ha 1.00 to 1.50 L/ha	Apply in the spring when crop growth commences until early shotblade stage. Treat when the legumes are in an early stage of development and covered by a canopy of weeds and crop. Apply in 180-240 L of water per hectare.

Table 7. Winter Wheat And Fall Rye Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

		ANNUAL BROAD LEAVES								GRASSES				PERENNIALS			WINTER ANNUALS		
Treatment	**Trade Name**	buckwheat, wild	corn spurry	hempnettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	barnyard grass	foxtails	quack grass	wild oats	bindweed, field	sow-thistle	thistle, Canada	chickweed	shepherd's purse	stinkweed
2,4-D	2,4-D*	F	P	P	P	E	E	E	E	P	P	P	P	F	G	F	P	E	E
MCPA	MCPA*	P	F	G	P	E	E	E	E	P	P	P	P	F	G	G	P	E	E
MCPB/MCPA (15:1)	TROPOTOX PLUS	P	P	G	P	E	E	E	G	P	P	P	P	G	E	E	P	E	E
dichlorprop/2,4-D	ESTAPROP	G	P	F	G	E	E	E	E	P	P	P	P	F	G	G	P	E	E
dicamba	BANVEL	E	E	F	G	E	P	E	E	P	P	P	P	G	G	G	G	P	P

Table 7. Winter Wheat And Fall Rye Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

		ANNUAL BROAD LEAVES								GRASSES				PERENNIALS			WINTER ANNUALS		
Treatment	**Trade Name**	buckwheat, wild	corn spurry	hempnettle	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	barnyard grass	foxtails	quack grass	wild oats	bindweed, field	sow-thistle	thistle, Canada	chickweed	shepherd's purse	stinkweed
dicamba/2,4-D/mecoprop	KIL-MOR	E	E	G	G	E	E	E	E	P	P	P	P	G	G	G	G	E	E
dicamba/MCPA/mecoprop	TARGET	E	E	G	G	E	E	E	E	P	P	P	P	G	G	G	G	E	E
dicamba + MCPA	BANVEL + MCPA*	E	E	P	G	E	E	E	E	P	P	P	P	G	G	G	G	E	E
dicamba + 2,4-D	BANVEL + 2,4-D*	E	E	P	G	E	E	E	E	P	P	P	P	G	G	G	G	E	E
bromozynil	PARDNER[1]	E	P	P	E	E	G	G	G	P	P	P	P	F	F	F	P	G	G
bromoxynil/MCPA	BUCTRIL M[1]	E	P	F	E	E	E	G	E	P	P	P	P	F	F	F	P	E	E
diclofop-methyl	HOE-GRASS 284	P	P	P	P	P	P	P	P	G	G	P	E	P	P	P	P	P	P
glyphosate	ROUNDUP	P	P	P	P	P	P	P	P	P	P	E	P	E	E	E	P	P	P

* *Various formulations available, see Table 1.*

[1] *Can be used as a fall or spring treatment. All other treatments except glyphosate are for spring treatment only. Glyphosate can be used only before planting or after harvest.*

WHEAT (WINTER) AND FALL RYE

NOTE: Apply all treatments in 100 to 200 L water per hectare except where otherwise noted.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Many broadleaf annual and winter annual weeds including pepper-grass, shepherd's purse and stinkweed (pennycress)	amine 2,4-D* 2,4-D (500 g/L) amine or sodium MCPA MCPA AMINE (500 g/L)	0.350 to 0.550 kg/ha 0.70 to 1.10 L/ha 0.350 to 0.850 kg/ha 0.70 to 1.70 L/ha	Treat in the spring when the crop growth begins until the early shotblade stage. For control of winter annuals apply early before flower buds appear on the weeds.

Many broadleaf annual weeds	bromoxynil PARDNER (280 g/L)	0.280 to 0.336 kg/ha 1.00 to 1.20 L/ha	Winter wheat may be treated from the 2 to 4 leaf stage in the fall or from the time growth begins to early flag leaf stage in the spring. More effective on winter annuals when applied as a fall treatment.
Many broadleaf annual and winter annual weeds	bromoxynil/ MCPA (1:1) BUCTRIL M ((1:1) 560 g/L)	0.560 kg/ha 1.00 L/ha	Winter wheat may be treated from the 2 to 4 leaf stage in the fall or from the 2 to early leaf stage in the spring.
Many broadleaf annual and winter annual weeds, Canada thistle and perennial sow-thistle in winter wheat	dicamba BANVEL 480 (480 g/L)	0.110 to 0.139 kg/ha 0.23 to 0.29 L/ha	Apply in the spring when the crop is 15 to 25 cm tall before the shotblade stage. Can be used with 2,4-D or MCPA amine 0.42 kg/ha **(0.84 L/ha of 500 g/L formulations)***. The addition of 2,4-D or MCPA will give improved control of pepper-grass, shepherd's purse and pennycress. DO NOT USE ON FALL RYE.
Many broadleaf annual and winter annual weeds, Canada thistle and perennial sow-thistle in winter wheat	2,4-D/ dicamba/ mecoprop KILMOR (485 g/L)	0.413 to 0.534 kg/ha 0.85 to 1.10 L/ha	Apply in early spring when winter annual weeds are in the rosette stage. Apply before the crop is more than 30 cm high (top leaf extended).
	dicamba/ MCPA/ mecoprop TARGET (400 g/L)	0.400 to 0.600 kg/ha 1.00 to 1.50 L/ha	Apply in spring before the crop is more than 30 cm high (top leaf extended). Winter annuals should be sprayed as soon as new growth starts. Apply when other weeds are in the 2 to 3 leaf stage.
	dicamba/ MCPA (1:4) DYVEL ((1:4) 420 g/L)	0.505 kg/ha 1.20 L/ha	Apply to winter wheat in the spring when weeds have emerged and the crop is 15 to 25 cm tall before the shotblade stage.
Many broadleaf annual and winter annual weeds	dichlorprop/ 2,4-D ESTAPROP ((282:300) 582 g/L) DIPHENOPROP (600 G/L) ((1:1) 600 g/L)	1.017 kg/ha 1.75 L/ha 1.75 L/ha	Apply in early spring to emerged weeds. May be used until cereals are up to the flag leaf stage.
Loose silky bentgrass in the fall	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.995 kg/ha 3.50 L/ha	Apply in the fall to loose silky bentgrass at the 1 to 4 leaf stage in winter wheat or fall rye.
	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.383 to 0.546 kg/ha 0.70 to 1.00 L/ha 0.80 to 1.20 L/ha	Apply as soon as possible after planting. Incorporate shallowly into the soil surface with drag harrows. Seed the crop approx. 5 cm deep to separate the germinating seed from the chemical.
Emerged annual grass weeds including wild oats	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.710 to 0.795 kg/ha 2.50 to 2.80 L/ha	Apply in the spring when the annual grasses are in the 1 to 5 leaf stage. The higher rate (2.8 L/ha) must be used to control wild oats in the 4 to 5 leaf stage. Do not use if rain is expected within 1 hour after application. Bromoxynil (PARDNER) may be tank mixed with diclofop-methyl for control of many broadleaf weeds. See the label and remarks on PARDNER above for further details about broadleaf weed control.
Emerged quackgrass	glyphosate** ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	A minimum of 2 season control. Apply in 100-300 L/ha of water when the quackgrass is actively growing with at least 3-4 new leaves on each emerged shoot. Apply before planting or after harvest. (Important: see "Notes on Chemicals" section for more information.)
	glyphosate** ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	A minimum of one season control. Apply before planting or after harvest in 50-100 L/ha of water. Use when the quackgrass is actively growing with at least 3-4 new leaves on each emerged shoot. Use flat-fan nozzle tips. For use in higher water

volumes, the addition of a surfactant Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

---

* *Additional formulations are available. Use rates that give comparable amounts of active ingredient. See Table 1.*

** *Additional glyphosate products are available. See Table 1.*

CONSERVATION TILLAGE

Minimum Tillage involves very little use of tillage equipment for seedbed preparation. The soil, however, is tilled prior to seeding resulting in somewhat rough planting conditions by conventional standards with very little living vegetation and a crop residue cover of more than 20% after seeding. Weed control in this cropping system is in most respects similar to weed control in conventional tillage. Preplant incorporated herbicide treatments may not be practical if crop residues are heavy. Good uniform soil mixing is required to produce satisfactory results with incorporated herbicides. If this condition cannot be achieved without extra tillage, then the preferred method would be to use preemergent or postemergent herbicides. Use of inter-row cultivation is recommended in conjunction with herbicides. Burndown treatments are not normally required.

Ridge Tillage involves seeding the crop directly into the ridge formed by aggressive cultivation the previous year. The ridge planter skims off the 2 to 5 cm of soil, crop residue, weeds and weed seeds from the top of the ridge and deposits these in the hollows between the rows. Preplant incorporated treatments are impractical with this system. This system is well suited to broadcast and/or banded applications of preemergent or postemergent herbicides. Excellent results have been obtained by band applying preemergent herbicides at planting time to fresh, moist soil directly behind the seeding unit on the planter. Also, timely cultivation between crop rows while, at the same time, spraying the crop row with postemergent herbicides can provide excellent weed control. The ridging procedure that follows provides additional mechanical weed control. Proper adjustment of the ridge planter and early cultivation after seeding may eliminate the need for a burndown treatment. A burndown treatment may be required prior to crop emergence if cultivation is delayed after seeding.

Strip Tillage suggests that only narrow bands of soil in the seeding area are tilled by either power driven rotovators or fluted coulters. The area between rows is left untilled and the crop residue is undisturbed. Success with preplant incorporated treatments depends on the amount and type of residue, the nature of the specific herbicide and the tilling device used. Row middles are not usually cultivated but could be if appropriate equipment is available for inter-row cultivation. Most often broadcast application of preemergent or postemergent herbicides are used. Band applications could be used if inter-row cultivation is an integral part of the production system. If vegetation is present at seeding time, a burndown treatment is necessary.

No-Till cropping systems are the most demanding with regards to weed control. The crop is seeded directly into untilled soil with no follow-up cultivation. Weed control depends entirely on herbicides. Burndown treatments are almost always required. Preemergent and postemergent herbicides are used to control weeds throughout the entire growing season. Crop residues may intercept a portion of preemergent herbicide. If rainfall is sufficient to wash the herbicide from the crop residue into the soil, weed control results will be satisfactory. However, if dry conditions follow application, results could be very disappointing. Postemergent foliar applied herbicides are more appropriate under dry conditions.

Weed Population Shifts refers to the change in kinds of troublesome weeds that occur with a change in tillage systems. When tillage is reduced the environment of weed seeds and underground parts of perennial weeds is altered. These environmental alterations are to the benefit of some weed species and the detriment of others. Deep burial of weed seeds under conventional tillage systems enforces seed dormancy and increases the longevity of seeds, perpetuating weed problems. Reducing tillage keeps more weed seeds at the soil surface where they are subject to the ravages of nature. Greater percentages of seed at the soil surface are destroyed before they germinate (winterkill). A higher percentage of those seeds that do survive germinate sooner and, if they are controlled, they do not return seeds to the soil. If good weed control is obtained in the early years of reduced tillage, eventually the weed seed bank in the soil should become depleted, reducing the potential of serious weed problems that originate from seed. Pressure from annual weeds tends to decline after a few years in reduced tillage. On the other hand, reduced tillage favors weeds that have prolific vegetative reproductive capacity from underground roots and stems. The underground parts are not mechanically injured or destroyed in reduced tillage systems. Perennial and biennial weeds tend to be more troublesome in ridge-till, strip-till and no-till fields. In reduced tillage fields, these weeds emerge earlier and remain more localized than they do in conventionally tilled fields. This allows more appropriate timing for spray application and more spot treatments. The most effevtive herbicides are foliar-applied systemic types that translocate well to under ground plant parts before the above ground parts are killed. When non selective herbicides are used, these weeds must be treated between crops or the crop must be sacrificed in treated areas.

Burndown treatments are meant to kill existing vegetation prior to crop emergence. Burndown treatments may be required in minimum tillage, especially when cover crops are used; in ridge-till when seeding in delayed and/or when winter annual, biennial or perennial weeds are present; and almost always in no-till and strip-till fields. Vegetation can be killed by: (a) contact herbicides like paraquat; (b) translocated systemic herbicides like glyphosate, dicamba or 2,4-D; (c) residual herbicides that have postemergence foliar activity such as atrazine, cyanazine, linuron or metribuzin plus surfactants or oils; and (d) a contact or systemic herbicide tank mixed with a residual herbicide such as paraquat + atrazine or glyphosate + dicamba. All of these treatments are most effective on young, actively growing plants. Coverage is extremely important with contact treatments. Burndown treatments do not necessarily provide residual weed control.

When dense, vigorous growing vegetation is present just before or at planting time, large amounts of soil moisture are removed by that vegetation. This can be an advantage during springs when there is an over abundance of soil moisture, but is a definite disadvantage during springs when dry conditions prevail. Because of this situation, consideration should be given to early application of burndown herbicides, perhaps even the previous fall when perennial cover crops or sod fields are involved. Under dry conditions, a rapid acting burndown would be preferred over a slower acting treatment.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Burndown prior to any crop			
Annual weeds and rye and wheat cover crops	glyphosate* ROUNDUP (356 g/L)	0.850 to 1.250 kg/ha 2.39 to 3.51 L/ha	Glyphosate can be applied to actively growing weeds and/or cover crops in the fall or spring prior to emergence of any crop. Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. For perennial grass control apply to actively growing plants with at least 3-4 new leaves. The low rate (2.5 L/ha) will provide a minimum of one season control while higher rates (4.75 to 7L/ha) will provide longer term control. The low rate must be applied in 50 to 100 L water per hectare. Apply the low rate plus a surfactant if greater volumes of water are used. Higher rates may be applied in 100 to 300 L water per hectare. Canada thistle should be at least in early bud, milkweed at bud, and bindweed at full flower for best results. Dandelions, red clover and orchard grass may escape, particularly at low rates. Follow burndown application with any suitable herbicide treatment recommended in the conventional tillage sections for a specific crop.
Quackgrass and many other perennial grasses	glyphosate* ROUNDUP (356 g/L)	0.900 to 2.500 kg/ha 2.53 to 7.03 L/ha	See above remarks on glyphosate.
Other perennials	glyphosate* ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	See above remarks on glyphosate.
Annual weeds, annual cover crops suppression or burn of top growth of perennial weeds	paraquat GRAMOXONE (200 g/L)	0.550 to 1.100 kg/ha 2.75 to 5.50 L/ha	Apply paraquat to actively growing vegetation at least 3 days prior to crop emergence. Use the high rate when weeds are above 5 cm in height. Apply paraquat in 300 to 1100 L of water per hectare. Complete coverage is important. Use higher water volumes on dense vegetation. Perennial weeds will only be suppressed. Only emerged weeds will be controlled. Follow burndown application with any suitable herbicide treatment recommended in the conventional tillage section for a specific crop.

Burndown and Residual Control in Corn

Emerged weeds and grasses and suppression of unplowed grass sod	paraquat GRAMOXONE (200 g/L) plus atrazine AATREX NINE-O (90 WG) AATREX (480 g/L)	0.550 to 1.100 kg/ha 2.75 to 5.50 L/ha 1.530 kg/ha 1.70 kg/ha 3.18 L/ha	Apply in the spring in 325 to 500 L water per hectare at least 3 days prior to crop emergence. Some perennial species may escape (alfalfa, brome grass and orchard grass). Consideration should be given to follow up treatments when the corn is at the approximate stage of growth with herbicide treatments recommended for use in the conventional tillage corn section.

Burndown and Residual Control in Soybeans

Germinating and emerged annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L)	0.100 kg/ha 0.42 L/ha	Imazethapyr may be applied up to 30 days prior to planting for control of many annual grass and broadleaf weeds. For minimum tillage, only one working of the soil to prepare a seedbed is recommended following application. This final seedbed preparation should not be deeper than 10 cm and should not turn untreated soil to the surface. Addition of a non-ionic surfactant and liquid fertilizer is required if emerged weeds are present at application.
Quackgrass, germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L) plus glyphosate ROUNDUP (356 g/L)	0.100 kg/ha 0.42 L/ha 0.836 to 0.890 kg/ha 2.35 to 2.50 L/ha	See imazethapyr and glyphosate instructions for details.
Germinating annual grass and broadleaf weeds including triazine resistant species	imazethapyr PURSUIT (240 g/L) plus paraquat GRAMOXONE (200 g/L)	0.100 kg/ha 0.42 L/ha 0.550 to 1.100 kg/ha 2.75 to 5.50 L/ha	See imazethapyr and paraquat instructions for details.

Spot Treatments in Corn and Soybeans

Canada thistle	glyphosate* ROUNDUP (356 g/L)	1.691 to 2.492 kg/ha 4.75 to 7.00 L/ha	Crops will be killed in the areas sprayed and may be damaged by spray drift in adjacent areas. Knapsack applications of 100 mL Roundup in 5 L of water applied to thoroughly wet the foliage but not runoff is suggested for small areas to reduce drift and areas of crops affected. Apply after field bindweed has reached full flower, Canada thistle has started flowering, milkweed has reached the flower bud stage, and quackgrass has at least 4 leaves and is actively growing.
Milkweed, field bindweed and other perennials	glyphosate* ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	

* *Additional glyphosate products are available, consult Table 1.*

SPECIAL NOTES FOR CONSERVATION TILLAGE

All herbicides recommended for use in specific crops in the conventional tillage sections of this publication can be used in conservation tillage systems provided that they are used according to the labelled uses and the labelled rates.

HORTICULTURAL CROPS

Many horticultural crops are damaged by some of our common herbicides. Sprayers that have been used for hormone-type (2,4-D, etc) chemicals SHOULD NOT BE USED for applying insecticides, fungicides or herbicides on susceptible horticultural crops.

The treatments listed in this publication are based on extensive field trials and observations on farms. **Herbicides should not be used in cold frames or greenhouses unless specifically recommended.**

The higher value per hectare of most horticultural crops compared with field crops sometimes justifies the use of more expensive chemicals. Their correct use should result in savings in cultivation, hand weeding, and other costs. Sometimes weeds escape a chemical treatment and cultivation is necessary. Such weeds should be considered escapes when they reach the 3 to 4 leaf stage.

It is difficult to control quackgrass, field bindweed, horsetail and similar perennial weeds in crops such as asparagus, strawberries, raspberries, etc., which occupy the same area for a period of years. Perennial weeds of this type should be eradicated or brought under control before these crops are planted.

The recommendations for some of the horticultural crops such as snap beans and sweet corn will be found in the field crops section because they are similar to those for field beans, and field corn. Differences have been noted where necessary.

Weed Control In Gardens

Many garden plants can be killed or damaged by the chemicals used to kill weeds. The frequent use of a hoe, or other shallow cultivation, is the most pratical method of controlling weeds in gardens. Most annual weeds can be killed with one or two cultivations. Perennial weeds can be killed by any kind of cultivation which removes all top growth at frequent intervals. After the food stored in the roots has been used, the weeds will die.

When it is possible to apply the chemical to one kind of garden plant, without danger of spray or dust drifting onto susceptible garden plants, one of the chemicals recommended in this publication may be used. (Check list below.) Granular formulations can be applied using a jam jar with a perforated top. This "salt shaker" method, after a little practice, is effective and quick. A small compressed air sprayer can be used to apply any liquid or wettable powder which is mixed with water. It is important that the correct amount be applied. One way of ensuring accuracy is to fill the garden sprayer with water to a mark - apply the spray to 100 m^2 taking care to apply it as evenly as possible, and then measure the amount of water used. Add the chemical recommended in the publication to this amount of water for each 100 m^2 treated.

As a guide in converting the recommended rate of any chemical to the amount required for a small area, 32 g per 100 m^2 is approximately equal to 3.25 kg per hectare. For liquid measure, 2 level tbs is approximately 28 mL. On L of spray mixture per 100 m^2 is equal to 100 L per hectare.

The herbicides listed under each crop are available for farm, custom spraying, and industrial use. **The Ontario Pesticides Act restricts the sale of herbicides to the home gardener to those with a domestic label.** These are:

Generic Name	Example of Product
ammonium sulfamate	- Poison-Ivy and Bursh Killer, Brush Killer A
amitrole	- Backyard clean-up
amitrole-simazine mixture	- Vegetation Killer, Steril Liquid
chloramben	- Garden Weeder, Ornamental Weeder, Weed Preventer, No-Hoe
chlorthal dimethyl	- Dacthal
dalapon	- Quack Grass Killer
EPTC	- Eptam, Weed Preventer
2,4-D + mecoprop	- Premium Spot Weed Killer
paraquat/diquat mixtures	- Soluble granules
chlorate/borate mixtures	- Total Vegetation Control, Steril Granular
trifluralin	- Fertilizer mixtures, Weed Preventer, Weed-Stop
various crabgrass control chemicals	- Betasan, Dacthal, trifluralin/fertilizer mixtures and Crabgrass Preventer
2,4-D	- Lawn Weed Killer, fertilizer mixtures

VEGETABLE CROPS

Contact Herbicides

These materials kill all aboveground foliage on contact. Contact herbicides can be used in a stale seedbed technique. The seedbed is prepared early to allow a delay of seeding for several weeks. After the weeds have emerged, but before the crop has emerged, paraquat or diquat (3 to 5.5 L (product) in 250 to 1000 L water per hectare) is applied. The soil should be disturbed as little as possible after treatment or a new crop of weeds will appear. These herbicides are registered for this use on beans, beets, carrots, cole crops, onions, peas, potatoes, sweet corn and rutabagas.

Inter-row weeding with a contact herbicide such as paraquat (3 to 5.5 L (product) in 250 to 1000 L water per hectare) can be used as a rescue operation where other methods of weed control have failed. The herbicide is directed between the crop rows onto the emerged weeds. Use special low pressure (7 to 15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. This technique of weeding with paraquat is registered for use on beans, beets, carrots, cole crops, cucumbers, lettuce, onions, potatoes, sweet corn and tomatoes.

Preplanting Treatments

Preplanting treatments are applied before the crop is sown or planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated in the soil by cultivation soon after application. Check the label.

Selective Preemergence Herbicides

These materials prevent emergence of many weed seedlings without reducing crop stand. This type of material should be applied immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Selective Postemergence Herbicides

These chemicals are applied after the crop plants have sprouted, or after the crop has been transplanted. Applied as directed, the weeds can be killed without injury to the crop. The weeds should be small for best results.

ASPARAGUS

NOTE: All treatments should be applied in 150 to 300 L water per hectare unless otherwise specified.

WEEDS	**Generic Name** **TRADE NAME** **(Formulation)**	**Rate (Active)** **RATE** **PRODUCT**	**REMARKS (For more information, see "Notes on Chemicals" section.)**
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL-SITE PREPARATION for details of rate and remarks.

Before Emergence of Direct-Seed Asparagus

Germinating annuals	paraquat	0.600 to 1.100 kg/ha	Apply in 300 to 1100 L water per hectare. Spray on emerged weeds before crop emergence. Apply preemergence treatment to next crop of weeds. Direct seeding of asparagus is only practical if weeds can be controlled from the time of seeding until the asparagus plants develop an extensive root system. Paraquat can be used as a "chemical mower" to kill emerged seedling weeds when the first asparagus seedlings are beginning to emerge. To note development, monitor germination progress of asparagus by frequent examination of germinating seeds. Soon after this application, the chloramben or napropamide preemergence treatment should be made to extend the period of weed control. To be effective, these must be separate applications.
	GRAMOXONE (200 g/L)	3.00 to 5.50 L/ha	
	chloramben	2.250 to 3.250 kg/ha	
	AMIBEN (10 Gr)	22.50 to 32.50 kg/ha	
	napropamide	2.250 to 4.500 kg/ha	
	DEVRINOL 50W (50 WP)	4.50 to 9.00 kg/ha	

1st Year Crown-Established

Germinating annuals	chloramben	2.250 to 3.250 kg/ha	Treat at planting time, or soon after planting before weed seedlings appear. Use lower rate on sandy soils and the higher rate on clay soils. Do not use on marketable asparagus, as a residue tolerance has not been established.
	AMIBEN (10 Gr)	22.50 to 32.50 kg/ha	
	napropamide	2.250 to 4.500 kg/ha	
	DEVRINOL 50W (50 WP)	4.50 to 9.00 kg/ha	

2nd Year and Established Asparagus

Germinating annuals	diuron	1.750 to 2.250 kg/ha	Disk before any shoots appear in the spring on established plantings. This may be followed by one of the following herbicides. Linuron, diuron, metribuzin or simazine should be applied immediately after the spring disking before weeds germinate in established asparagus. A second application may be made after the postharvest disking.**CAUTION**: The lower rates are recommended for lighter soils. Rates are given for overall sprays; reduce proportionately if only rows are sprayed. Extreme caution is needed if diuron or simazine is used in rotations where susceptible crops are to be grown one year after application. Use simazine only on established plantings of 3 years and older.
	KARMEX (80 DF)	2.19 to 2.81 kg/ha	
	linuron	1.750 to 2.250 kg/ha	
	LOROX DF (50 DF)	3.50 to 4.50 L/ha	
	AFOLAN F (480 g/L)	3.64 to 4.68 L/ha	
	metribuzin	1.100 to 2.250 kg/ha	
	SENCOR 500 F (500 g/L)	2.20 to 4.50 L/ha	
	SENCOR 75 DF (75 WG)	1.46 to 2.99 kg/ha	
	simazine	2.200 kg/ha	
	PRINCEP NINE-T (90 WG)	2.44 kg/ha	
Germinating annual grasses, lamb's-quarters and pigweed including triazine resistant species	trifluralin	1.000 to 2.000 kg/ha	Application should occur early enough in the spring to ensure that spears are not injured by the required incorporation (5-10 cm). Use only on established plantings of 3 years or older.
	TREFLAN (545 g/L)	1.83 to 3.66 L/ha	
	RIVAL (500 g/L)	2.00 to 4.00 L/ha	

Before Spear Emergence or After Last Cutting			
Germinating annuals	paraquat GRAMOXONE (200 g/L)	0.600 to 1.100 kg/ha 3.00 to 5.50 L/ha	Apply in 300 to 1100 L water per hectare. Paraquat should also be applied on weed seedlings before asparagus tips appear or after the last cutting. Do not apply to emerged spears which are to be used for human consumption. It is particularly effective for control of grass. Use the higher volume of water on dense weed growth.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.000 to 3.250 kg/ha 4.00 to 6.50 L/ha	The paraquat/simazine formulation can be applied after weed emergence but before crop emergence. A second application may be applied after harvest. These treatments are recommended for established plantings only and must not be used on direct seeded asparagus or on young plants during the first growing season after planting. Use the lower rate on sandy soils or on soils low (1 to 2%) in organic matter.
Germinating annual grasses, lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	1.000 to 2.000 kg/ha 1.83 to 3.66 L/ha 2.00 to 4.00 L/ha	Apply after last cutting of spears (post harvest disking) and incorporate as indicated on the label. Use only on established plantings of three years or older.
Postemergence			
Emerged annual grasses including volunteer corn and barley	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply to asparagus only after the spears have been harvested. Do not treat spears prior to or during harvest. Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.
During Harvest Immediately After Cutting			
Non grass annuals, some perennials	2,4-D	1.100 to 1.750 kg/ha	Apply in 50 to 100 L water per hectare. May be applied early in the season just after a cutting.
After Last Cutting			
Perennial weeds	amitrole AMITROLE-T (240 g/L)	4.600 kg/ha 19.00 L/ha	Amitrole-T may be used as a spot treatment to control small patches of perennial weeds. The application should be made when the weeds are actively growing. Apply with a knapsack or garden sprayer to wet the leaves of the weeds, avoiding the asparagus fern as much as possible. For larger area, mow after the last cutting and spray immediately.
	amine 2,4-D	1.100 to 1.750 kg/ha	Apply in 50 to 100 L water per hectare. Apply 3 weeks after the post cutting disking. Direct spray to avoid wetting the asparagus tops.

BEANS (LIMA) *

NOTE: Use 150 to 300 L of water per hectare unless stated otherwise.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other emerged weeds	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	In 100 to 300 L of water per hectare in the previous fall or in the spring before the crop is planted. A minimum of 2 seasons control is obtained at these rates.
	glyphosate* ROUNDUP (356 g/L)	0.890 kg/ha 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50 to 100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.

* *Various glyphosate products are available. See Table 1.*

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS
Preplant Incorporated			
Germinating annual grasses, lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 0.820 kg/ha 1.10 to 1.50 L/ha 1.20 to 1.60 L/ha 1.50 to 2.00 L/ha	The use of metobromuron or monolinuron preemergence or postemergence bentazon application will control additional broadleaf weeds. Rates and application techniques vary between products. Consult product labels and "Notes on Chemcials" section.
Germinating annual grasses, nutsedge, annual nightshades	metolachlor DUAL (960 g/L)	1.683 to 2.644 kg/ha 1.75 to 2.75 L/ha	Metolachlor must be preplant incorporated before seeding the crop. Set tillage equipment such as tandem disks or S-tine cultivators to a depth of 10 cm and thoroughly incorporate in one direction. Immediate incorporation is not necessary. This herbicide lasts 10 to 14 weeks in the soil. It is effective over a wide range of soil types but should not be applied to muck, peat muck or high organic matter soils. Perennial weeds, other than nutsedge, are not controlled. Metobromuron or monolinuron applied preemergence or bentazon postemergence will control annual broadleaf weeds which may escape metolachlor.
Preemergence			
Germinating common annual broadleaf weeds including ragweed, lamb's-quarters, pigweed and mustards	metobromuron PATORAN FL (400 g/L) PATORAN (50 WP)	1.125 to 1.375 kg/ha 2.81 to 3.44 L/ha 2.25 to 2.75 kg/ha	Beans should be seeded at least 5 cm deep. Injury may occur if beans are under stress. Beans in the early stage of growth may also be injured from treated soil having been splashed up onto the leaves by a rainstorm. A shallow harrowing or rotary hoeing after application of the chemical will reduce the possibility of splash up and help activate the chemical if dry weather follows application. Inter-row cultivation may be required when the lowest recommended rate is used. Label rates for Patoran flowable range from 2.5 to 4.25 L/ha.

	monolinuron AFESIN (200 g/L)	1.100 to 1.400 kg/ha 5.50 to 7.00 L/ha	
Postemergence			
Emerged annual broadleaf weeds, yellow nutsedge, Canada thistle and suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.841 to 1.082 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	Use 100 to 400 L of water per hectare. Apply when beans are in unifoliate to 4th trifoliate leaf stage and weeds are small and actively growing. Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled. Two applications of 1.75 L/ha (0.84 kg ai/ha) 10 days apart may be required to control the perennial weeds. Use the 2.25 L/ha (1.08 kg/ha) rate for annual broadleaf weeds.
Green and yellow foxtail, barnyard grass, old witch grass, wild oats, fall panicum and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.994 kg/ha 3.50 L/ha	Diclofop-methyl should be applied postemergence to annual grasses and volunteer corn in the 1 to 4 leaf stage (optimum control at the 2 to 3 leaf stage, approximately 10 to 16 days after emergence). Do not apply if rain is expected within one hour of application. Other herbicides should not be tank mixed with diclofop-methyl. Other postemergence herbicides should be applied 4 days before or after diclofop-methyl application. Annual broadleaf weeds must be controlled with other herbicides.
Emerged annual grasses, proso millet, wild oats, volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.295 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Lima beans are tolerant at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Use the higher rate for wild oats, and volunteer corn and cereals. Complete control is normally obtained 7 to 21 days after application. Apply using 110 to 200 L/ha of water.
Quackgrass and annual grasses	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will result in more uniform quackgrass emergence. Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L of water per hectare for 6 to 8 weeks of control. Use MERGE at a rate of 1% volume per volume of water.
Split Applications			
Germinating annual broadleaf weeds and grasses	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L) followed by metobromuron PATORAN FL (400 g/L) PATORAN (50 WP) or by monolinuron AFESIN (200 g/L) or by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.601 to 0.820 kg/ha 1.10 to 1.50 L/ha 1.20 to 1.60 L/ha 1.50 to 2.00 L/ha 1.125 to 1.375 kg/ha 2.81 to 3.44 L/ha 2.25 to 2.75 kg/ha 0.750 to 1.100 kg/ha 3.75 to 5.50 L/ha 0.841 to 1.082 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on trifluralin under the preplant incorporation section. See remarks on metobromuron, and monolinuron under the preemergence section. See remarks on bentazon under the postemergence section.

Germinating annual broadleaf weeds and grasses, nutsedge, annual nightshades	metolachlor DUAL (960 g/L) followed by metobromuron PATORAN FL (400 g/L) PATORAN (50 WP) or by monolinuron AFESIN (200 g/L) or by bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	1.680 to 2.640 kg/ha 1.75 to 2.75 L/ha 1.125 to 1.375 kg/ha 2.81 to 3.44 L/ha 2.25 to 2.75 kg/ha 0.750 to 1.100 kg/ha 3.75 to 5.50 L/ha 0.841 to 1.082 kg/ha 1.75 to 2.25 L/ha 2.000 L/ha	See remarks on metolachlor under the preplant incorporation section. See remarks on metobromuron, and monolinuron under the preemergence section. See remarks on bentazon under the postemergence section.

BEETS (RED)

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preplant Incorporated			
Germinating grasses	pebulate TILLAM (720 g/L) cycloate RO-NEET (720 g/L)	4.500 to 6.750 kg/ha 6.26 to 9.38 L/ha 3.250 to 4.500 kg/ha 4.52 to 6.26 L/ha	Apply in 150 to 300 L water per hectare. Use on mineral soils only. Pebulate and cycloate should be applied to a dry soil surface before planting and incorporated. Use the lower rate on sandy soils. These treatments are usually not effective on highly organic soils.
Preemergence			
Germinating broadleaf weeds	pyrazon PYRAMIN FL (430 g/L)	3.550 to 4.500 kg/ha 8.27 to 10.49 L/ha	Apply in 150 to 300 L water per hectare. Use only on mineral soils.
Germinating grasses	TCA NATA GRASS KILLER PELLETS (85 SG)	5.500 to 6.750 kg/ha 6.49 to 7.97 L/ha	Use only on mineral soils.
Germinating grasses and broadleaf weeds	pyrazon PYRAMIN FL (430 g/L) plus TCA NATA GRASS KILLER PELLETS (85 SG)	3.550 to 4.400 kg/ha 8.27 to 10.25 L/ha 5.500 to 6.750 kg/ha 6.49 to 7.97 L/ha	Pyrazon is best applied at planting time as a preemergence banded treatment for the control of most annual broadleaf weeds.

Postemergence			
Annual broadleaf weeds	pyrazon PYRAMIN FL (430 g/L)	3.550 kg/ha 8.27 L/ha	Apply in 250 mL Citowett Plus, or in 17 L emulsifiable light mineral oil and 300 to 400 L water per hectare. Oil should be light paraffin based oil having 95 to 110 US viscosity with over 90% of unsulfonatable residues and suitably emulsified.

CABBAGE, CAULIFLOWER, BROCCOLI, BRUSSELS SPROUTS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preplant Incorporated			
Germinating annual grasses and good control of lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha	Direct seeded cabbage or cauliflower or transplants of cabbage, cauliflower, broccoli and Brussels sprouts. Incorporate after applications.
Preemergence			
Germinating grasses and some broadleaf weeds	chlorthal dimethyl DACTHAL WP (75 WP)	9.000 to 11.000 kg/ha 11.97 to 14.63 kg/ha	Apply in 250 L water per hectare on mineral soils. Apply immediately after seeding or directly over transplants, preemergence to weeds. Chlorthal dimethyl must be applied uniformly to the soil as a spray. This herbicide can be sprayed directly over transplants without injury. If weeds have emerged, cleanly cultivate the soil before application. Rainfall or irrigation (about 1 cm) is necessary for activation.
Postemergence			
Emerged annual grasses including volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	NOT REGISTERED FOR USE ON BRUSSELS SPROUTS. Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.

CARROTS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preplant Incorporated			
Germinating annual grasses and good control of lamb's-quarters and pigweed species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha	Incorporate after application.
Preemergence			
Annuals	linuron LOROX DF (50 DF) AFOLAN F (480 g/L)	0.600 to 1.100 kg/ha 1.20 to 2.20 kg/ha 1.25 to 2.29 L/ha	Apply in 150 to 300 L water per hectare. Linuron when used as a preemergence treatment should be applied soon after seeding. Use the lower rate on sandy soils. Carrots are very sensitive to this treatment at time of emergence and severe injury can take place at this time if there is a heavy rain, or if the area is irrigated. When used as a postemergence treatment, apply after carrots are 8 cm high. The carrot leaves will become yellow or light green but they will soon regain their normal green color. Do not use more than 1.1. kg per hectare on sandy soils. Injury may occur when spraying is done during hot, dry weather, or when the crop is under stress. For preemergence plus postemergence treatment use a maximum of 0.8 kg (active) in the second spray.
	prometryne GESAGARD (80 WP)	1.800 to 3.400 kg/ha 2.25 to 4.25 kg/ha	Apply in 150 to 300 L water per hectare. Use the lower rate on sandy soils and the higher rate on muck soils. Prometryne should also be applied soon after seeding. Do not use at or near time of emergence. IT IS NOT REGISTERED FOR POSTEMERGENCE USE.
	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) followed by linuron LOROX DF (50 DF) AFOLAN F (480 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha 0.600 to 1.100 kg/ha 1.20 to 2.20 kg/ha 1.25 to 2.29 L/ha	A preplanting application of trifluralin on mineral soils can control most weeds until the carrots have developed to the stage at which the linuron postemergence treatment can be used.

	prometryne GESAGARD (80 WP) followed by linuron LOROX DF (50 DF) AFOLAN F (480 g/L)	1.800 to 3.400 kg/ha 2.25 to 4.25 kg/ha 0.600 to 1.100 kg/ha 1.20 to 2.20 kg/ha 1.25 to 2.29 L/ha	A combination procedure which has been successful on muck soils is to use the preemergence prometryne treatment followed by a postemergence linuron treatment as required.
	chloramben AMIBEN (10 Gr)	3.250 to 4.500 kg/ha 32.50 to 45.00 kg/ha	On muck soils, the higher rate gives weed control when sufficient rain carries the chemical into the weed germinating zone.

Postemergence

Annuals	mineral oil (herbicidal) **overall spray** **rows only undiluted**	 600.00 to 800.00 L/ha 300.00 to 400.00 L/ha	Apply the selective herbicidal oil as soon as true leaves develop and before roots or carrots are thicker than a pencil. Later treatments may produce an oil flavor. Weeds should be less than 10 cm high. Ragweed, wormwood, and wild carrot are not controlled.
	linuron LOROX DF (50 DF) AFOLAN F (480 g/L)	1.100 to 2.250 kg/ha 2.20 to 4.50 kg/ha 2.29 to 4.68 kg/ha	Apply in 150 to 300 L water per hectare after carrots are 8 to 15 cm high, before grasses exceed 5 cm in height and before broadleaf weeds exceed 15 cm. Do not apply when temperature exceed 32C as crop injury may result.
Green and yellow foxtail, barnyard grass, fall panicum, old witch grass, wild oats and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	1.000 kg/ha 3.52 L/ha	Diclofop-methyl should be applied postemergence to annual grasses in the 1 to 4 leaf stage (optimum control at 2 to 3 leaf stage, approximately 10 to 16 days after emergence). Do not apply if rain is expected within one hour after application.
Emerged annual grasses including volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.

CELERY

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Seedling annuals	mineral oil (herbicidal) **overall spray** **rows only undiluted**	 600.00 to 800.00 L/ha 300.00 to 400.00 L/ha	Herbicidal oil should be used only on outdoor seedbed and only if the soil is moist. Apply as the true leaves develop on the celery, before weeds are 10 cm high.
	linuron AFOLAN F (480 g/L)	0.900 to 2.250 kg/ha 1.87 to 4.68 L/ha	Apply in 150 to 300 L water per hectare in the transplanted crop. Linuron should be applied 8 to 10 days after transplanting. Some yellowing of the leaves may be noticed but this will be temporary.

	prometryne GESAGARD (80 WP)	2.250 kg/ha 2.81 kg/ha	Apply in 150 to 300 L water per hectare in the transplanted crop. Do not use on direct seeded crop. Prometryne applications should be delayed 8 to 10 days after transplanting crop until the celery plants are established.

CUCUMBER

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.836 to 4.270 kg/ha 2.35 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preplant Incorporated			
Germinating annual grasses	bensulide PREFAR (480 g/L)	5.770 to 6.730 kg/ha 12.00 to 14.00 L/ha	Preplant incorporated on mineral soils only.
Germinating annual broadleaf weeds and grasses	bensulide PREFAR (480 g/L) followed by naptalam ALANAP (240 g/L)	4.567 to 6.730 kg/ha 9.50 to 14.00 L/ha 2.278 to 4.556 kg/ha 9.50 to 19.00 L/ha	Bensulide should be applied before planting and incorporated thoroughly into the soil to a depth of 2.5 to 5 cm. Do not use on muck soils. Bensulide and naptalam may also be tank mixed and applied preplant incorporated. When tank mixed with naptalam, incorporation should be to a depth of 2.5 cm or less. Use power driven rotary cultivators or other equipment which will result in satisfactory incorporation. Use the lower rates in light, sandy soils.
Preemergence			
Germinating annuals	naptalam ALANAP (240 g/L)	2.638 to 7.194 kg/ha 11.00 to 30.00 L/ha	ALANAP may also be applied as a postemergence spray about one month after the preemergence spray when the crop has emerged following a clean cultivation.
Postemergence			
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.295 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Cucumbers are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 to 200 L/ha water volume.

Emerged quackgrass	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.506 kg/ha 2.75 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L water per hectare. Use MERGE at a rate of 1% V/V. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.

* *Additional products are available. See Table 1.*

DILL (See Herbicidal Oil under Carrots)

LETTUCE

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating annuals	chlorpropham CIPC EC (480 g/L)	4.500 to 6.750 kg/ha 9.36 to 14.04 L/ha	Apply in 150 to 300 L water per hectare. When overhead irrigation is used at seeding time, delay chlorpropham application until after first irrigation but before crop emergence. Use lower rates in cool, wet weather to avoid injury and delay in emergence. Use lower rates in mineral soils.

MUSKMELON, WATERMELON, SQUASH AND PUMPKIN

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.836 to 4.270 kg/ha 2.35 to 12.00 L/ha	See section under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for rates and remarks.
Preemergence			
Germinating annuals	naptalam ALANAP (240 g/L)	2.638 to 7.194 kg/ha 11.00 to 30.00 L/ha	DO NOT USE ON BUTTERNUT SQUASH; some injury may occur to Table Queen squash. ALANAP may be applied to melons (not squash or pumpkins) as a postemergence spray about 1 month after the preemergence spray when the crop has emerged but before the weeds are up.
	granular chloramben AMIBEN (10 Gr)	2.250 kg/ha 22.50 kg/ha	Amiben granular may be applied as an overall or band treatment. Treat at planting time or soon after planting but before weed seedlings emerge. Use in pumpkin and squash fields only. DO NO USE chloramben FOR MUSKMELON AND WATERMELON. Apply chloramben immediately after seeding squash or pumpkin to control most annual broadleaf weeds and grasses. Stunting and delayed

maturity may result if heavy rainfall follows application. If dry weather continues after application, a light cultivation may be used to improve weed control and remove emerged weeds.

* *Additional products are available. See Table 1.*

ONIONS

Most experience with herbicides below has been with the seeded crop. Experience with sets and limited experience with Spanish onions have been satisfactory. On green bunching onions, the granular formulations (applied when the leaves are dry) are recommended to avoid leaf injury.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preemergence			
Germinating annuals and seedling grasses	chlorpropham CIPC EC (480 g/L) CIPC GR (10 Gr)	4.500 to 9.000 kg/ha 9.36 to 18.72 L/ha 45.00 to 90.00 kg/ha	Apply in 150 to 300 L water per hectare, or granular, on muck soils. Use 4.50 to 6.75 kg (active) on mineral soils. Preemergence or directed postemergence. Chlorpropham is most effective when the weed seeds are germinating. Under cool, moist conditions reduction in stand with decrease in yields has occurred. Direct the postemergence spray to avoid onion leaves. Excellent control of purslane may be obtained. Groundsel, lamb's-quarters and ragweed are somewhat resistant. Do not use this chemical on bunching onions.
Germinating grasses and some broadleaf weeds	chlorthal dimethyl DACTHAL WP (75 WP)	9.000 to 11.000 kg/ha 11.97 to 14.63 kg/ha	Apply in at least 250 L water per hectare, preemergence on mineral soils. Chlorthal dimethyl should be applied as a preemergence treatment as it kills germinating weed seeds only. It is not effective on muck soils.
Postemergence			
NOTE: Most experience with these herbicides has been with the seeded crop. Experience with sets and limited experience with Spanish onions have been satisfactory. On green bunching onions, the granular formulations (applied when the leaves are dry) are recommended to avoid leaf injury.			
Emerged annual grasses including volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occurs after application.
Annual grasses and some broadleaf weeds	pendimethalin PROWL (480 g/L)	3.000kg/ha 6.25L/ha	Pendimethalin can be applied at the loop and/or 2 leaf stage of crop development. Both applications are required for season long control. Pendimethalin controls weeds as they emerge. Destroy existing weeds prior to application. For use on direct seeded dry bulb onions grown in muck soil only.

Emerged broadleaf weeds	oxyfluorfen GOAL (192 g/L)	0.120 kg/ha 0.63 L/ha	Apply in 500 L/ha of water at the 2 fully developed leaf stage of onions. Repeat applications to control late germinating weeds to a maximum of 2 1/2 L/ha. PERMITS are required from the Ministry of the Environment under the Pesticides Act for the use of GOAL (oxyfluorfen). Permit applications should be made to the Ministry of Environment Pesticide Control Field Officers.
Green and yellow foxtail, barnyard grass, fall panicum, old witch grass, wild oats and volunteer oats and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	1.000 kg/ha 3.52 L/ha	Diclofop-methyl should be applied postemergence to annual grasses in the 1 to 4 leaf stage (optimum control at 2 to 3 leaf stage, approximately 10 to 16 days after emergence). Do not apply if rain is expected within one hour after applications.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/ha 0.81 to 1.63 L/ha 2.000 L/ha 1.000 L/ha	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray cover. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 to 200 L/ha water volume.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/hag/ha 4.34 L/ha 4.000 L/ha 1.000 to 2.000L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1-3 leafstage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
Annual grasses including volunteer cereals	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	Volunteer cereals will be controlled with 0.8 L/ha. A repeat application may be made to control annual grasses, if required, but not less than 42 days before harvest. Apply in a maximum volume of 300 L/ha. See "Notes on Chemicals" section. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
Emerged quackgrass and emerged annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus AGRAL 90	0.250 to 0.500 kg/ha 1.00 to 2.00 L/ha	Use the higher rate when quackgrass is present. Preplant tillage to break up rhizomes will improve control of quackgrass. Deep plowing may hinder the break up of rhizomes. Apply in a maximum volume of 300 L/ha. Only one application of this rate is permitted per season and it should be no less than 60 days to harvest. See "Notes on Chemicals" section.AGRAL 90 to be applied 1 litre in 1000 litres spray solutions.

PARSLEY (See Herbicidal Oil under Carrots)

PARSNIPS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Germinating annuals	chlorpropham CIPC EC (480 g/L) CIPC (20 Gr)	4.500 to 9.000 kg/ha 9.36 to 18.72 L/ha 22.50 to 45.00 kg/ha	Chlorpropham should be used at the lower rate on mineral soils and at the higher rate on muck. Apply at time of seeding or until shortly before emergence of crop and weeds.
	linuron AFOLAN F (480 g/L)	1.100 to 2.250 kg/ha 2.29 to 4.68 L/ha	Apply in 150 to 300 L water per hectare at seeding. Linuron, when used as a preemergence treatment, should be applied soon after seeding. Use lower rate on sandy soils. Heavy rains or irrigation at time of emergence may cause injury. When used postemergence, apply after parsnips are 8 cm high. Do not use more than 1.1. kg (active) on sandy soils. Applications when the temperature is high may cause injury, especially at the higher rates.
Emerged weeds	mineral oil (herbicidal) **overall spray** **row only undiluted**	 600.00 to 800.00 L/ha 300.00 to 400.00 L/ha	Herbicidal oil should be applied as soon as true leaves develop and before roots of parsnips are thicker than a pencil. Later treatments may produce an oil flavor. Weeds should be less than 10 cm high.
	linuron AFOLAN F (480 g/L)	1.100 to 2.250 kg/ha 2.29 to 4.68 L/ha	Apply in 150 to 300 L water per hectare after parsnips are 8 to 15 cm high (see note above).

PEAS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.

Germinating annual grasses and good control of lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 0.800 kg/ha 1.10 to 1.46 L/ha 1.20 to 1.60 L/ha	Incorporate after application.
Germinating weeds including Eastern black nightshade	prometryne GESAGARD (80 WP)	1.800 to 2.200 kg/ha 2.25 to 2.75 kg/ha	Apply in 200 to 300 L water per hectare. Preemergence.
Many seedling annual broadleaf weeds	MCPA MCPA - sodium salt or MCPA MCPA amine	0.38 kg/ha 0.50 L/ha	Apply in 100 to 200 L water per hectare. Postemergence.
Many seedling annual broadleaf weeds and Canada thistle.	MCPB/MCPA (15:1) TROPOTOX PLUS (400 g/L)	1.100 to 1.700 kg/ha 2.75 to 4.25 L/ha	Apply in 150 to 200 L of water per hectare when the peas have 3 to 6 expanded leaves.
Emerged annual broadleaf weeds, including triazine resistant strains, yellow nutsedge, Canada thistle and suppression of field bindweed	bentazon BASAGRAN (480 g/L) plus surfactant CITOWETT PLUS ASSIST oil concentrate	1.100 kg/ha 2.29 L/ha 2.000 L/ha	Apply in 100 to 400 L water per hectare postemergence after the peas have 3 pairs of leaves. Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.84 kg ai/ha); 10 days apart may be required. **CITOWETT PLUS to be applied 0.25 litres in 100 litres spray solution.**
Wild oats	triallate AVADEX BW (400 g/L)	1.500 to 1.750 kg/ha 3.75 to 4.38 L/ha	Apply in 150 to 200 L water per hectare for dry peas only. Preplant incorporated.
Wild oats, green and yellow foxtail, barnyard grass, old witch grass and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	0.700 kg/ha 2.46 L/ha	For optimum weed control apply diclofop-methyl when the majority of the grass weeds are in the 2 to 3 leaf stage. Spray tips angled forward at 45 will give better coverage. Do not apply if rain is expected within one hour after application.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/ha 0.81 to 1.63 L/ha 2.000 L/ha 1.000 L/ha	Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110-200 litres per hectare water volume.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 4.000 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1-3 leaf stage of actively growing quackgrass. Apply in 110 to 200 litres per hectare of water. Use MERGE at a rate of 1% v v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
Emerged Canada thistle and perennial sow-thistle	amitrole AMITROL-T (200 g/L)	4.500 kg/ha 22.50 L/ha	Apply after harvest to emerged actively growing weeds. Wait 10 to 14 days after spraying before working the area.
Emerged annual grasses including volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Second flush annual grasses will not be controlled if emergence occured after application.

PEPPERS

NOTE: All treatments should be applied in 150 to 300 L water per hectare.

Discussion of cultural methods can be found in the tomato section.

Weed control in the pepper crop is accomplished best by combining chemical and cultural methods.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate ROUNDUP (356 g/L)	0.854 to 4.270 kg/ha 2.40 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for rates and remarks.
Preplant Incorporated			
Germinating annual grasses and good control of lamb's-quarters and pigweed, including triazine resistant species	trifluralin TREFLAN (545 g/L) TRIFLUREX 40 EC (400 g/L) RIVAL (500 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.50 to 2.75 L/ha 1.20 to 2.20 L/ha	Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or vibrating tine cultivator (10-13 km/hr) set to work 8-10 cm deep. The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. (see label). The second incorporation is recommended anytime before planting. See "Notes on Chemicals" section for further details. If shallow cultivation is to be used to control additional broadleaf weeds, cultivation should start when the weeds have reached the 3 to 4 leaf stage.
After Transplants Established			
Germinating annual grasses and broadleaf weeds	chloramben AMIBEN (10 Gr)	4.500 kg/ha 45.00 kg/ha	Apply 2 weeks after transplanting after crop is established but preemergence to weeds. Control weed escapes with cultivation. Do not apply chloramben granular to wet pepper foliage. Mustards and cocklebur are not controlled. Chloramben (Amiben G) can follow a preplant incorporated application of trifluralin to provide broadspectrum annual weed control.

* *Additional glyphosate products are available. See Table 1.*

POTATOES

NOTE: A combination of chemical weed control with cultivation provides the best weed management system. Cultivation prior to potato emergence using various kinds of cultivation equipment (ligh harrows, finger weeders, hillers, etc.) will control the early flush of weeds. Root pruning of the crop should be minimized. If the crop is hilled after application of herbicides, it must be realized that areas of untreated soil will surface where another flush of weeds may result.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and other weed species	glyphosate* ROUNDUP (356 g/L)	0.854 to 4.270 kg/ha 2.40 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION (for details of rates and remarks).
Preplant Incorporated			
Germinating annual grasses	EPTC EPTAM (800 g/L)	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha	Apply EPTC to a dry soil surface before planting and incorporate immediately. When applied under wet soil conditions weed control is poor.
Germinating annual grasses and broadleaf weeds	EPTC EPTAM (800 g/L) plus metribuzin SENCOR 500 F (500 g/L)[1] or metribuzin LEXONE DF (75 DF)[2]	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha 0.550 to 0.875 kg/ha 1.10 to 1.75 L/ha 0.624 to 0.902 kg/ha 0.83 to 1.20 kg/ha	Apply as a tank mix in 220 to 330 L water per hectare. Do not use on muck soils. Do not use on **Belleisle, Tobique** or on red skinned varieties.
Nutsedge and germinating annual grasses	metolachlor DUAL (960 g/L)	1.923 to 2.644 kg/ha 2.00 to 2.75 L/ha	Do not use metolachlor on the variety **Superior**, or on sandy or coarse textured soils low in organic matter. Do not apply **Dual** at ground crack or if potatoes have emerged.
Nutsedge, germinating annual grasses and broadleaf weeds	metolachlor DUAL (960 g/L) plus metribuzin SENCOR 500 F (500 g/L) or metribuzin LEXONE DF (75 DF)	1.923 to 2.644 kg/ha 2.00 to 2.75 L/ha 0.550 to 1.125 kg/ha 1.10 to 2.25 L/ha 0.624 to 0.902 kg/ha 0.83 to 1.20 L/ha	The tankmix should not be used on the varieties SUPERIOR, BELLEISLE, TOBIQUE or on RED SKINNED varieties. Do not apply on sandy or on coarse textured soils low in organic matter or on muck soils. Do not apply at ground crack or if potatoes have emerged.
Nutsedge	EPTC EPTAM (800 g/L)	4.400 to 6.800 kg/ha 5.50 to 8.50 L/ha	Apply EPTC to a dry soil surface before planting and incorporate immediately. Use high rates for heavy weed infestations.

* *Additional glyphosate products are available. See Table 1.*

[1] *Sencor (75 DF) equivalent is 0.73 to 1.18 kg/ha*

[2] *Lexone (480 g/L) equivalent is 1.30 to 1.88 L/ha*

Split Applications

Nutsedge and germinating annuals	metolachlor	1.920 to 2.640 kg/ha	Apply metolachlor and incorporate thoroughly, Use one of the other chemicals preemergence to weeds and crop after the first hilling. Metribuzin may be applied preemergence or early postemergence. Do not use metribuzin on muck soils or on **Belleisle, Tobique** or red skinned varieties.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	followed by one of the following:		
	metobromuron	1.125 to 1.625 kg/ha	
	PATORAN (50 WP)	2.25 to 3.25 kg/ha	
	PATORAN FL (400 g/L)	2.92 to 4.20 L/ha	
	or linuron	0.880 to 1.120 kg/ha	
	AFOLAN F (480 g/L)	1.83 to 2.33 L/ha	
	LOROX DF (50 DF)	1.76 to 2.24 kg/ha	
	or monolinuron	1.100 to 1.700 kg/ha	
	AFESIN (200 g/L)	5.50 to 8.50 L/ha	
	or metribuzin	0.550 to 1.125 kg/ha	
	SENCOR 500 F (500 g/L)[1]	1.10 to 2.25 L/ha	
	or metribuzin	0.624 to 0.902 kg/ha	
	LEXONE DF (75 DF)[2]	0.83 to 1.20 kg/ha	

---

1 Sencor (75 DF) equivalent is 0.73 to 1.5 kg/ha

2 Lexone (480 g/L) equivalent is 1.3 to 1.88 L/ha

Preemergence

Germinating annuals	metolachlor	1.923 to 2.644 kg/ha	Metolachlor as a tank mix plus one of the herbicides listed, should be applied before emergence of the crop and weeds after the first hilling. Do not use metribuzin on muck soils or on **Belleisle, Tobique**, or red skinned varieties. Use the lower rates on sandy soil. For more information about linuron see the remarks for linuron below.
	DUAL (960 g/L)	2.00 to 2.75 L/ha	
	tank mixed with one of following		
	metobromuron	1.125 to 1.625 kg/ha	
	PATORAN (50 WP)	2.25 to 3.25 kg/ha	
	PATORAN FL (400 g/L)	2.92 to 4.20 L/ha	
	or monolinuron	1.100 to 1.700 kg/ha	
	AFESIN (200 g/L)	5.50 to 8.50 L/ha	
	or metribuzin	0.550 to 1.125 kg/ha	
	SENCOR 500 F (500 g/L)[1]	1.10 to 2.25 kg/ha	
	or metribuzin	0.624 to 0.902 kg/ha	
	LEXONE DF (75 DF)[2]	0.83 to 1.20 kg/ha	
	or linuron	0.880 to 1.120 kg/ha	
	LOROX DF (50 DF)	1.76 to 2.24 kg/ha	
	AFOLAN F (480 g/L)	1.83 to 2.33 L/ha	
Germinating annual broadleaf weeds, some annual grasses	linuron	1.100 to 2.250 kg/ha	Linuron can be applied immediately after hilling but the potato tops must be covered with soil or the potato plants will be injured. Use the lower rate on light sandy soils and the higher rate on muck or clay soils.
	LOROX DF (50 DF)	2.20 to 4.50 kg/ha	
	AFOLAN F (480 g/L)	2.29 to 4.68 L/ha	
	metobromuron	1.000 to 3.400 kg/ha	Metobromuron may be applied immediately after planting or hilling provided the tops are covered with soil during application. Application may be made when weeds have emerged provided they do not exceed 2.5 cm and tops are not exposed. Use the lower rate on light sandy soil and the higher rates on clay and muck soils. PATORAN FL (400 g/L) at the 2.5 L/ha rate may allow certain annual weeds to
	PATORAN FL (400 g/L)	2.50 to 8.50 L/ha	
	or metobromuron	1.625 to 2.750 kg/ha	
	PATORAN (50 WP)	3.25 to 5.50 kg/ha	

			escape. Inter-row cultivation may be necessary for full season control.
	monolinuron AFESIN (200 g/L)	1.100 to 2.200 kg/ha 5.50 to 11.00 L/ha	Monolinuron can be applied immediately after hilling but all the potato tops must be covered with soil or the crop will be injured. Use the lower rate on soils low in organic matter and the higher rate on clay or soils high in organic matter.
	metribuzin SENCOR 500 F (500 g/L)³ or metribuzin LEXONE DF (75 DF)⁴	0.600 to 1.100 kg/ha 1.20 to 2.20 L/ha 0.481 to 1.053 kg/ha 0.64 to 1.40 kg/ha	Apply after hilling before emergence of crop or weeds. DO NOT USE ON MUCK SOILS. Use the lower rate on sandy soil. Do not use on **Belleisle, Tobique,** or red skinned varieties. Metribuzin may be applied as pre/post split application provided the maximum total application rate does NOT exceed 1.12 kg active/ha.
	prometryne GESAGARD (80 WP) Use 3.40 kg/ha on muck soils. (4.25 kg/ha of 80 WP)	2.200 to 2.600 kg/ha 2.75 to 3.25 kg/ha	Addition of a surfactant or an emulsifiable oil will improve control where annual grasses predominate. Apply on small weeds just before, or at emergence of the crop. Use the lower rate on coarse sandy soils.
Emerged weeds	paraquat GRAMOXONE (200 g/L)	0.600 to 0.850 kg/ha 3.00 to 4.25 L/ha	Apply in 275 to 550 L water per hectare to emerged weeds. Use on **Netted Gem and Cherokee** varieties before emergence. Apply on other varieties until 25 to 30% of the crop has emerged but none of the tops should be over 5 to 8 cm in height. Temporary yellowing on the tops will occur. Do not use on emerged potato plants in the evening, under cloudy conditions or when the plants are under moisture stress.

1 *Sencor (75 DF) equivalent is 0.73 to 1.5 kg/ha*
2 *Lexone (480 g/L) equivalent is 1.3 to 1.88 L/ha*
3 *Sencor (75 DF) equivalent is 0.8 to 1.47 kg/ha*
4 *Lexone (480 g/L) equivalent is 1.0 to 2.2 L/ha*

Postemergence

Annual grasses, wild oats and volunteer corn	diclofop-methyl HOE-GRASS 284 (284 g/L)	1.000 kg/ha 3.52 L/ha	DO NOT USE IN TANK MIX WITH OTHER HERBICIDES. Apply when the majority of the grass weeds are in the 2 to 3 leaf stage. Do not apply if rain is expected within an hour of application. Other postemergence herbicides should be applied at least 4 days before or after diclofop-methyl applications.
Emerged annual grasses including volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply when majority of annual grasses are in the 1 to 6 leaf stage or until volunteer corn is up to 25 cm tall. Do not apply if rainfall is expected within one hour after application. Second flush annual grasses will not be controlled if emergence occurs after application.
Emerged annual grasses including wild proso millet, wild oats, volunteer corn and spring cereals	sethoxydim POAST (184 g/L) plus ASSIST oil concentrate or surfactant/solvent MERGE	0.150 to 0.300 kg/ha 0.81 to 1.63 L/ha 2.000 L/ha 1.000 L/ha	Potatoes are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after treatment. Apply using 110 to 200 L/ha water volume. Use the higher rate for volunteer cereal control.

	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.250 kg/ha 0.60 to 1.00 L/ha	Apply to actively growing annual grasses at the 2 to 4 leaf stage for foxtails, and the 2 to 5 leaf stage for other. Best results are obtained when fluazifop-butyl is applied prior to tillering. Application beyond the 5 leaf stage will not provide control. Use the low rate for volunteer corn; the high rate for foxtails, wild oats, proso millet, and crabgrass; the median rate for other grasses. Fluazifop-butyl may be tank mixed with metribuzin for broad spectrum weed control apply at least 90 days before harvest. AGRAL 90 to be applied at 1 litre in 1000 litres spray solution.
Late germinating grasses	EPTC EPTAM (800 g/L)	3.400 to 4.400 kg/ha 4.25 to 5.50 L/ha	Incorporate immediately at next to the last or last cultivation. This treatment may be of value if an earlier treatment has failed or if late germinating grasses are a problem.
Emerged annual weeds	metribuzin SENCOR 500 F (500 g/L)[1] or metribuzin LEXONE DF (75 DF)	0.600 to 1.100 kg/ha 1.20 to 2.20 L/ha 0.624 to 0.772 kg/ha 0.83 to 1.03 kg/ha	Apply early postemergence soon after emergence of the crop and before weeds are 4 cm high. Do not use postemergence on red skinned varieties or on potatoes grown for the early market, or on the **Shepody** variety. DO NOT USE ON MUCK SOIL as a residue may injure vegetable crops sown the following season.
Postemergence lay-by annual broadleaf weeds	chloramben AMIBEN (10 Gr)	2.250 to 4.500 kg/ha 22.50 to 45.00 kg/ha	Clean cultivate soil to remove all growing weeds among the potato vines. Apply chloramben immediately after cultivation and before any weed seedlings emerge. Use on **white** potato varieties only.
Emerged quackgrass and annual grasses including wild proso millet, wild oats, volunteer corn and spring cereals.	sethoxydim POAST (184 g/L) plus ammonium sulphate (tech grade) BASF LIQUID AMMONIUM SULPHATE (490 g/L) plus oil concentrate ASSIST oil concentrate or plus surfactant/solvent MERGE	0.500 kg/ha 2.72 L/ha 2.00 kg/ha 4.00 L/ha 2.000 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6 to 8 weeks.
	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.500 kg/ha 2.00 L/ha	Rhizomes of quackgrass should be thoroughly fragmented by tillage prior to application. Apply to actively growing plants that have 3 to 5 leaves. Do not cultivate for at least 5 days after application. Fluazifop-butyl may be tank mixed with metribuzin. Apply at least 90 days before harvest. AGRAL 90 to be applied 1 litre in 1000 litres of spray solution.

---

[1] *Sencor (75 WP) equivalent is 0.80 to 1.47 kg/ha*

SPECIAL NOTES FOR POTATOES

POTATO VINE KILLING - For information on products and rates of application of vine killing, refer to the Potato Section of OMAF Publication 363, *Vegetable Production Recommendations.*

RUTABAGA

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.854 to 4.270 kg/ha 2.40 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION for rates and remarks.
Preplant Incorporated			
Germinating annual grasses and some control of lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.820 to 1.148 kg/ha 1.50 to 2.10 L/ha 1.60 to 2.20 L/ha	See: "Notes on Chemicals" section for details. If shallow cultivation is to be used to control additional broadleaf weeds, it should start when the weeds have reached the 3 to 4 leaf stage.
Germinating annual grasses, annual nightshades and nutsedge	metolachlor DUAL (960 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha	Incorporate metolachlor thoroughly.
Preemergence			
Germinating annual grasses and annual nightshades	metolachlor DUAL (960 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha	Lasts 10-14 weeks in the soil.

* *Additional products are available. See Table 1*

SPINACH

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass, Canada thistle, bindweed and any emerged annual broadleaf weeds and grasses	glyphosate ROUNDUP (356 g/L)		See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for details of rates and remarks.
Preplant Incorporated			
Germinating grasses	cycloate RO-NEET (720 g/L)	3.400 kg/ha 4.73 L/ha	Preplant incorporated in 150 to 300 L water per hectare on mineral soils only. Cycloate should be applied to a dry soil surface before planting, and incorporated within 10 minutes with a double disk. A second incorporation at right angles in

			tandem with a harrow should follow as soon as possible. Use the lower rate on sandy soils.
Preemergence			
Germinating annuals	chlorpropham CIPC EC (480 g/L)	1.300 to 5.000 kg/ha 2.70 to 10.40 L/ha	Preemergence in 150 to 300 L water per hectare on mineral soils only. Chlorpropham should be used at higher rates during warm weather (between May 1 to October 15) on heavy soils. Use lower rates during cool season (between October 15 to May 1) and on sandy loam soils.

TOMATOES

NOTE: All treatments should be applied in 150 to 300 L water per hectare unless otherwise specified.

Weed control in tomatoes usually consists of a combination of chemical weed control and cultivation. Crop rotation is also beneficial in the control of weeds. Cultivation should be shallow to prevent bringing untreated soil to the surface which may result in another flush of weeds. When tomatoes are grown on raised beds and beds are reshaped during the course of the season, it may be necessary or useful to apply another herbicide treatment to areas between the rows to prevent a new weed infestation from interfering with harvesting. Do not exceed the total recommended rate per season of any herbicide applied more than once per year.

Band treatment of herbicides over the row will reduce the cost by one-half to two-thirds depending on the width of the band compared to the row spacing. Shallow inter-row cultivation will be required for weed control between the rows.

Perennial weeds may be partially controlled by cultivation. Controlling them in crops other than tomatoes when grown in rotation is the best approach to perennial weed control. Perennials are easily spread with cultivators or tillage equipment. Areas of perennial weeds are best tilled last. Machinery sanitation is important when moving from one field to another.

TOMATOES (TRANSPLANTED)

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate ROUNDUP (356 g/L)	0.855 to 4.270 kg/ha 2.40 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION for rates and remarks.
Preplant Incorporated			
Germinating annual grasses, nutsedge, American and Eastern black nightshades	metolachlor DUAL (960 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha	Applied preplant followed by one incorporation with a double disk or vibrating shank (S-tine) cultivator operating at a depth of 10 cm. Lasts 10-14 weeks in the soil. Effective on most soils except high organic matter, muck or peat soils. Use only on transplant tomatoes grown for processing.

Germinating annual grasses, nutsedge and annual broadleaf weeds including American and Eastern Black nightshades	metolachlor DUAL (960 g/L) plus metribuzin SENCOR 500 F (500 g/L)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.250 to 0.700 kg/ha 0.50 to 1.40 L/ha	See above recommendations for metolachlor. Consult the metribuzin label for additional instructions. Use lower rate of metribuzin for plug plants and repeat applications of metribuzin when crop is established as described under postemergence application of metribuzin. Do not exceed total maximum rate of metribuzin recommended for your soil type.
Germinating annual grasses and some broadleaf weeds	napropamide DEVRINOL 50W (50 WP)	1.120 to 2.250 kg/ha 2.24 to 4.50 kg/ha	Use lower rates on lighter soils. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5.0 cm. Incorporate the same day as applied. After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected.
Germinating annual grasses, some annual broadleaf weeds and nutsedge	pebulate TILLAM (720 g/L)	4.500 to 6.700 kg/ha 6.26 to 9.31 L/ha	Apply to dry soil surface and incorporate immediately (see incorporation instructions for trifluralin).
Germinating annual grasses and some control of broadleaf weeds such as lamb's-quarters and pigweed including triazine resistant species	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha 1.50 to 2.75 L/ha	Incorporate twice in cross directions using a tandem disc (7-10 km/hr) or vibrating tine cultivator (10-13 km/hr) set to work 8-10 cm deep. The first incorporation should be done as soon as possible after application but may be delayed up to 8 to 24 hours. (See label.) The second incorporation is recommended anytime before planting. See "Notes on Chemicals" section for further details. Cool, wet weather may cause stunting of tomato transplants but yield is not usually affected.
Germinating annual grasses and annual broadleaf weeds	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) plus metribuzin SENCOR 500 F (500 g/L) LEXONE DF (75 DF)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha 0.250 to 0.700 kg/ha 0.50 to 1.40 L/ha 0.33 to 0.93 kg/ha	Follow incorporation instructions as above for trifluralin. Use only for processing tomatoes. The lower rates are for sandy soils and higher rates for clay soils. Use lower rate of metribuzin for plug plants. See "Remarks" for metolachlor plus metribuzin.

After Transplant Established Preemergence to Weeds

Germinating annual grasses and broadleaf weeds including some nightshades	chloramben AMIBEN (10 Gr)	4.500 kg/ha 45.00 kg/ha	Apply 2 weeks after transplanting when tomato plants are established but preemergence to weeds. Control escaped weeds with cultivation. Do not apply granular chloramben to wet tomato foliage. Mustards and cocklebur are not controlled. A rainfall or irrigation within 7 to 10 days after application is required to activate the herbicide.

Postemergence

Germinating and emerged annual grasses and broadleaf weeds	metribuzin SENCOR 500 F (500 g/L) LEXONE DF (75 DF) SENCOR 75 DF (75 WG)	0.250 to 0.850 kg/ha 0.50 to 1.70 L/ha 0.33 to 1.13 kg/ha 0.33 to 1.13 kg/ha	Use in processing tomatoes only. Apply before weeds exceed 5 cm in height. Direct spray to bottom one-third of tomato plants to reduce risk of crop injury. Apply 3 weeks after transplanting when tomato plants are established. Avoid application when crop is under stress due to cool, wet cloudy weather or excessively hot temperatures. Some tomato varieties are more sensitive than others. Use lower rates on sandy soils, higher rates on clay soils.

Emerged annual broadleaf weeds (1-4 leaf) and grasses (1-3 leaf) including triazine resistant species and nightshade	pyridate LENTAGRAN (45 WP) plus metribuzin LEXONE DF (75 DF) SENCOR 75 DF (75 WG) SENCOR 500 F (500 g/L)	0.450 to 0.900 kg/ha 1.00 to 2.00 kg/ha 0.150 to 0.300 kg/ha 0.20 to 0.40 kg/ha 0.20 to 0.40 kg/ha 0.30 to 0.60 L/ha	Use trifluralin ppi and then apply pyridate + metribuzin to actively growing weeds as a directed spray to the bottom (1/3) one-third of well established tomato plants. Do not use before tomato plants reach the 5 leaf stage or if the plants are under stress. Lentagran applied over tomato plants (not directed) will cause crop injury.
Emerged annual grass and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply to emerged grasses in the 1 to 6 leaf stage which are actively growing while crop is small enough to permit thorough coverage. A second application may be necessary to control grasses emerged after the first treatment.
Emerged annual grasses, wild oats, proso millet, volunteer corn, wheat and barley, Johnson grass, quackgrass and wirestem muhly	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Apply at 0.6 to 1 L/ha at 2 to 5 leaf stage of annual grasses. Apply at 1 to 2 L/ha at 3 to 5 leaf stage of quackgrass and wirestem muhly. Quackgrass top growth is suppressed at 1 L/ha. Thorough preplant tillage, fragmenting quackgrass rhizomes, improves control. Inter-row cultivation should not occur until 5 days after application. Do not tank mix with postemergence broadleaf weed herbicide. Apply other postemergence herbicides separately at least 3 days after fluazifop-butyl. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.294 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Tomatoes are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. Water rates of 50 to 200 L/ha provide the best results.
Quackgrass and annual grasses	sethoxydim POAST (184 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 4.000 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will result in more uniform quackgrass emergence. Apply at 1 to 3 leaf stage of actively growing quackgrass in 110 to 200 L water per hectare. Crop competition and inter-row cultivation 7 to 14 days after application will ensure quackgrass control for 6 to 8 weeks.

Preplant Incorporated followed by Postemergence

Germinating and emerged annual grasses and broadleaf weeds	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L) followed by metribuzin SENCOR 500 F (500 g/L) LEXONE DF (75 DF) SENCOR 75 DF (75 WG)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha 1.50 to 2.75 L/ha 0.250 to 0.850 kg/ha 0.50 to 1.70 L/ha 0.33 to 1.13 kg/ha 0.33 to 1.13 kg/ha	Preplant incorporate trifluralin. Then follow up with a directed postemergence application of metribuzin. See instructions above for both herbicides. Use lower rates of metribuzin for plug plants.

Germinating annual grasses and annual broadleaf weeds	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) plus metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG) followed by metribuzin SENCOR 500 F (500 g/L) SENCOR 75 DF (75 WG)	0.600 to 1.100 kg/ha 1.10 to 2.01 L/ha 1.20 to 2.20 L/ha 0.250 to 0.700 kg/ha 0.50 to 1.40 L/ha 0.33 to 0.93 kg/ha 0.430 to 0.700 kg/ha 0.86 to 1.40 L/ha 0.57 to 0.93 kg/ha	Follow incorporation instructions for the tank mix of trifluralin plus metribuzin as outlined above. Apply second application of metribuzin as a directed postemergence application to base of tomato plants, as outlined above for metribuzin applied postemergence. Use only on tomatoes for processing. Do not exceed total recommended rate of metribuzin when two applications are made for the soil type involved (see the label). Use the lower rates of metribuzin for plug plants.

Preemergence and Postemergence

Germinating and emerged annual grasses and broadleaf weeds including some nightshade control	chloramben AMIBEN (10 Gr) followed by metribuzin SENCOR 500 F (500 g/L) LEXONE DF (75 DF)	4.500 kg/ha 45.00 kg/ha 0.250 to 0.850 kg/ha 0.50 to 1.70 L/ha 0.33 to 1.13 kg/ha	Apply chloramben granular to established tomato transplants but preemergence to weeds, then control escaped weeds with metribuzin applied directed postemergence to crop and weeds. See instructions for chloramben and metribuzin above.

TOMATOES (FIELD SEEDED)

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant Incorporated			
Germinating annual grasses and some broadleaf weeds	napropamide DEVRINOL 50W (50 WP)	1.120 to 2.250 kg/ha 2.24 to 4.50 kg/ha	Use lower rates on light soils. Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5 to 5.0 cm. Incorporate the same day as applied. After harvest soil should be worked (across rows if banded) to prevent injury to succeeding crops. Small grains seeded in the fall may be stunted but not otherwise affected.
Postemergence			
Emerged annual grass and volunteer corn	fenoxaprop-ethyl EXCEL (90 g/L)	0.120 kg/ha 1.33 L/ha	Apply to emerged grasses in the 1 to 6 leaf stage which are actively growing while crop is small enough to permit thorough coverage. A second application may be necessary to control grasses emerged after the first treatment.
Emerged annual grasses, wild oats, proso millet, volunteer corn, wheat and barley, Johnson grass, quackgrass and wirestem muhly	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Apply at 0.6 to 1 L/ha at 2 to 5 leaf stage of annual grasses. Apply at 1 to 2 L/ha at 3 to 5 leaf stage of quackgrass and wirestem muhly. Quackgrass top growth is suppressed at 1 L/ha. Thorough preplant tillage, fragmenting quackgrass rhizomes, improves control. Inter-row cultivation should not occur until 5 days after application. Do not tank mix with postemergence broadleaf weed herbicide. Apply other postemergence herbicides separately at least 3 days after fluazifop-butyl. AGRAL 90 to be applied at 1 litre in 1000 litres spray solution.

Emerged annual grasses, wild proso millet, wild oats, volunteer corn and volunteer cereals	sethoxydim POAST (184 g/L) plus oil concentrate ASSIST oil concentrate or surfactant/solvent MERGE	0.147 to 0.294 kg/ha 0.80 to 1.60 L/ha 2.000 L/ha 1.000 L/ha	Tomatoes are tolerant to sethoxydim at any stage of growth. Apply sethoxydim to emerged grasses in the 1 to 6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. Complete control is normally obtained 7 to 21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. Water rates of 50 to 200 L/ha provide the best results.
Emerged quackgrass	sethoxydim POAST (184 g/L) plus surfactant/solvent MERGE	0.497 kg/ha 2.70 L/ha 1.000 to 2.000 L/ha	Thorough preplant tillage will provide more uniform quackgrass emergence. Apply at the 1 to 3 leaf stage of actively growing quackgrass. Apply in 110 to 200 L/ha of water. Use MERGE at a rate of 1% v/v. Crop competition and inter-row cultivation 7 to 14 days after application will provide quackgrass control for 6-8 weeks.

Table 8. Vegetable Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good		F - Fair, P - Poor	ANNUAL BROADLEAVES								ANNUAL GRASSES					PERENNIALS						
Treatment	Trade Name	Method of Application	buckwheat, wild	lady-s-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old witch grass	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
glyphosate	ROUNDUP	preplant	**	**	**	**	**	**	**	**	**	**	**	**	**	**	P	E	**	E	*	*
paraquat	GRAMOXONE	preplant	E	E	E	E	E	E	E	E	E	E	E	E	E		P			P	P	P
bensulide	PREFAR	preplant incorporated		P	P	P		F	F		E	E	G	E			P		P	P	P	P
cycloate	RO-NEET	preplant incorporated		F		P	G	G			G	G	F	G					F			
EPTC	EPTAM	preplant incorporated	P	F	G	P	G	F	F	P	E	E	G	E	E	P	F	P	G	P	P	P
metolachlor	DUAL	preplant incorporated	P	P	P	P	G	P	P	P	E	E	G	E	E	P	P	P	G	P	P	P
metribuzin	SENCOR, LEXONE	preplant incorporated	G	E	E	E	P	E	E	E	G	G	G	G	G	P	P	P	P	P	P	P
napropamide	DEVRINOL	preplant incorporated	P	F	E	P	P	E	F	P	E	E	E	E	E	P	P	P	P	P	P	P
pebulate	TILLAM	preplant incorporated		P	F	P	P	F	P		E	E	F	E					G	P		
triallate	AVADEX	preplant incorporated	P	P	P	P		P	P		P			P	P	P					P	P
trifluralin	TREFLAN or RIVAL or TRIFLUREX	preplant incorporated	F	P	G	P	P	G	P	P	E	E	E	E	E	P	P	P	P	P	P	P
chloramben	AMIBEN	preemergence	E	E	E	P	F	E	G	F	G	G	F	G	G	P	P	P	P	P	P	P

Table 8. Vegetable Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES								ANNUAL GRASSES					PERENNIALS						
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	lady-s-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old with grass	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
chlorpropham	CIPC	preemergence	E	E	F	P		G	P		E	E		E			P			P	P	P
chlorthal dimethyl	DACTHAL	preemergence	P	P	G	P	P	F	P		F	G	G	G			P			P	P	P
diuron	KARMEX	preemergence	G	G	E	G	G	G	E		E	E	F	E			P		P	P	P	P
linuron	LOROX or AFOLAN	preemergence	E	E	E	E	G	E	G	F	F	F	F	F	F	P	P	P	P	P	P	P
metobromuron	PATORAN	preemergence	E	E	E	E	G	E	G	F	F	F	F	F	F	P	P	P	P	P	P	P
metolachlor	DUAL	preemergence	P	P	P	P	G	P	P	P	E	E	G	E	E	P	P	P	P	P	P	P
metribuzin	SENCOR or LEXONE	preemergence	G	E	E	E	P	E	E	E	G	G	G	G	G	P	P	P	P	P	P	P
monolinuron	AFESIN	preemergence	E	E	E	E	G	E	G	E	F	F	F	F	F	P	P	P	P	P	P	P
naptalam	ALANAP	preemergence	P	G	G	F	P	F	P		P	F	P	F			P		P	P	P	P
paraquat/simazine	TERRAKLENE	preemergence	E	E	E	E	E	E	E	E	E	E	E	E	E				G	G		
prometryne	GESAGARD	preemergence	G	G	G	G	G	G	F		P	F		F			P			P	P	P
pyrazon	PYRAMIN	preemergence	G	G	G	G	G	G	G		P	P		P			P		P	P	P	P
simazine	PRINCEP-NINE-T	preemergence	E	E	E	E	E	E	E	F	E	G	F	E	E	P	P	P	F	F	P	P
TCA	NaTA	preemergence	P	P	P	P		P	P							P					P	P
bentazon	BASAGRAN	postemergence	F	E	G	E	F	F	E	E	P	P	P	P	P	G^1	P	P	G^1	P	G^1	G^1
diclofop-methyl	HOE-GRASS 284	postemergence	P	P	P	P	P	P	P	P	E	F	E	E	E	P	P	P	P	P	P	P
2,4-D*		postemergence	F	F	E	E	F	E	E	E	P	P	P	P	P	F	P	P	P	P	G	G
fenoxaprop-ethyl	EXCEL	postemergence	P	P	P	P	P	P	P	P	E	E	E	E	E	P	P	P	P	P	P	P
fluazifop-butyl	FUSILADE	postemergence	P	P	P	P	P	P	P	P	E	E	E	E	E	P	P	P	P	G	P	P
herbicidal oil*		postemergence		F	G	G		G	P							P	P	P	P	P	P	P
linuron	LOROX or AFOLAN	postemergence	E	E	E	E	E	E	E	E	E	F	E	G	E	F	G	F	G	F	G	F

Table 8. Vegetable Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			ANNUAL BROADLEAVES								ANNUAL GRASSES					PERENNIALS						
Treatment	**Trade Name**	**Method of Application**	buckwheat, wild	lady-s-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	barnyard grass	crabgrass	fall panicum	foxtails	old with grass	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
metribuzin	SENCOR or LEXONE	postemergence	G	E	E	E	P	E	E	E	G	G	G	G	G	P	P	P	P	P	P	P
MCPA*		postemergence	P	P	E	E		F	E	F	P	P	P	P	P	F	G	P	P	P	F	F
pyrazon	PYRAMIN	postemergence	G	G	G	G	G	G	G		P	P		P			P		P	P	P	P
pyridate + metribuzin	LENTAGRAN + SENCOR or LEXONE	post (Directed)	F	F	E	G	E	E	E	G	F	P		F		P	P	P	P	P	P	P
sethoxydim	POAST	postemergence	P	P	P	P	P	P	P	P	E	E	E	E	E	P	P	P	P	G	P	P

* *Various formulations available, see Table 1.*

** *Indicates the annual weeds will be controlled if emerged, and the perennials can be controlled if treated at the optimum time which is usually not the same time as for quackgrass.*

[1] *Good control of these perennial weeds may require two applications of BENTAZON + ASSIST oil concentrate about 7 to 10 days apart.*

CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in fruit crops, since there is a limited spectrum of herbicides registered for these crops.

Perennial Weed Control

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established orchards, vineyards, berry crops and nurseries.

The following perennial weeds present serious problems in these crops; quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock. In strawberries, sheep sorrel, toadflax and milkweed also present problems.

Appropriate herbicides such a glyphosate (Roundup) or amitrole (Amitrol-T) should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivations of some perennial weeds such as bindweed will also provide control.

Site Preparation

A green manure crop such as perennial rye-grass or sudan grass should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improving the soil structure. Non selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year.

Mulching

In the year of planting there are few herbicides registered for preemergence weed control. A biodegradable plastic mulch could be used for weed control in the planting strip. A straw mulch will assist in weed control beneath the trees or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the tree bases for winter rodent protection. Peastone gravel is another option that can be applied around the base of the trees. It will provide weed control as well as improving drainage, encouraging deeper rooting and discouraging rodents.

Reducing Weed Pressure

Cultivation can provide weed control between the rows. Alternatively, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed in a fescue sod than to rely on a natural sod composed of weed and grass species, since the weeds will seed into the herbicide strip.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds which escape before they set seed, by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the trees without injury. Mowing, however, will not eliminate weed competition.

Rotating Herbicide Families

In perennial crops, rotation of herbicide families is important to minimize the building up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

APPLES

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	metribuzin LEXONE DF (75 DF)	0.380 to 0.750 kg/ha 0.51 to 1.00 kg/ha	Apply as a preplant incorporated treatment in the year of planting. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	67 g CASORAN (4 G) applied to an area 2 x 2 m is equivalent to 175 kg per hectare. Do not apply until 4 weeks after transplanting. Do not use on light sandy soils.
	linuron[2] LOROX DF (50 DF) AFOLAN F (480 g/L)	4.500 kg/ha 9.00 kg/ha 9.40 L/ha	Apply as directed spray before weeds are 10 cm high in 400-600 L water per hectare. Add a surfactant. Avoid contact with fruit, foliage or tree bark with spray or drift. Use only under trees established at least 10 years.
	metolachlor DUAL (960 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	APPLY ONCE IN THE YEAR OF PLANTING ONLY. Do not use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves

	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. Do not apply when fruit is on the ground during harvest. Use only under trees established for at least one year.
	simazine PRINCEP NINE-T (90 WG)	0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	FOR TREES ESTABLISHED LESS THAN ONE YEAR. Apply once per season. Avoid contact with trunk and leaves of trees. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees.
	simazine[1] PRINCEP NINE-T (90 WG) SIMADEX (500 g/L)	2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha 4.50 to 9.00 L/ha	Apply in 300 to 1000 L water per hectare. Use only under trees planted for one year or more. Use higher rate on perennial weeds such as quackgrass. May be combined with glyphosate.
	terbacil SINBAR (80 WP)	1.800 to 3.600 kg/ha 2.25 to 4.50 kg/ha	Apply in 1000 L water per hectare. Use only under trees established for at least 3 years.
Emerged annual and perennial weeds, including Poison-ivy	amitrole AMITROL-T (200 g/L)	2.200 to 3.400 kg/ha 11.00 to 17.00 L/ha	Spray after weed foliage has fully developed. For grass and poison-ivy control, spray to wet all foliage, stems and suckers to the ground. Keep spray off tree trunks as much as possible. DO NOT USE WITHIN 30 DAYS BEFORE HARVEST.
Emerged annual weeds	glyphosate* ROUNDUP (356 g/L)	0.800 to 1.246 kg/ha 2.25 to 3.50 L/ha	Apply in 200 to 300 L of water per hectare. Remove all suckers from base of trunks before application. Apply as a directed spray. Do not apply to trees with "green" bark in the area of application. Do not apply within 30 days before harvest. Use preemergence herbicide to provide residual control of weed seedlings. For handgun applications, use a 1% solution for quackgrass and annual weeds, and a 2% solution for other perennial weeds. Can be applied with wiper equipment. Refer to section on "selective weed control with wiper applications". For site preparation, refer to "special methods of weed control".
Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	See remarks above on glyphosate.
Perennial weeds including poison-ivy	glyphosate* ROUNDUP (356 g/L)	2.500 to 4.270 kg/ha 7.03 to 12.00 L/ha	See remarks above on glyphosate.
Emerged annual and perennial weeds	glyphosate* ROUNDUP (356 g/L) plus simazine PRINCEP NINE-T (90 WG)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha 2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
	linuron[2] LOROX DF (50 DF) AFOLAN F (480 g/L)	4.500 kg/ha 9.00 kg/ha 9.36 L/ha	Apply as directed spray before weeds are 10 cm high in 400-600 L water per hectare. Add a surfactant. Avoid contact with fruit, foliage or tree bark with spray or drift. Use only under trees established at least 10 years.
	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1100 L water per hectare or apply 55 mL in 10 L of water sprayed to wet weed foliage. Use on trees established one year or more. Paraquat can be used in mixtures with terbacil to provide residual vegetation control as well as a quick knockdown.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.750 to 5.500 kg/ha 5.50 to 11.00 L/ha	This commercial mixture can be used after weeds have emerged to provide quick knockdown of weeds as well as residual control for most of the growing season.

			Use only under trees established for at least one year.
	paraquat GRAMOXONE (200 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.100 kg/ha 5.50 L/ha 2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
Emerged grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.250 to 0.500 kg/ha 1.00 to 2.00 L/ha	Use only under non-bearing apple trees. For annual grasses, apply 1 L/ha at the 2 to 5 leaf stage of grass. Treat quackgrass at the 3 to 5 leaf stage with 2 L/ha. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
	propyzamide KERB (50 WP)	2.250 kg/ha 4.50 kg/ha	Use only under apple trees established at least one year. 4.5 kg/ha is equivalent to 45 g/100 m^2.

* *Additional products are available. See Table 1.*
1 *SIMADEX (80 WP) equivalent rate is 2.75 to 5.5 kg/ha in 350 L water*
2. *LOROX L (480 g/L) equivalent rate is 9.0 L/ha*

CAUTION: Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of orchard.

APRICOTS

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	metolachlor DUAL (960 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	APPLY ONCE IN THE YEAR OF PLANTING ONLY. Do not use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
	metribuzin LEXONE DF (75 DF)	0.380 to 0.750 kg/ha 0.51 to 1.00 kg/ha	Apply as a preplant incorporated treatment in the year of planting. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
	simazine PRINCEP NINE-T (90 WG)	0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	FOR TREES ESTABLISHED LESS THAN ONE YEAR. Apply once per season. Avoid contact with trunk and leaves of trees. DO NOT use on sandy soils with less than 2% organic matter. Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees.
Emerged weeds and grasses	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L of water per hectare, or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more.
Emerged annual and perennial weeds	glyphosate ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under apples section for remarks.

CHERRIES & PLUMS

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	metolachlor DUAL (960 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	APPLY ONCE IN THE YEAR OF PLANTING ONLY. Do not use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
	metribuzin LEXONE DF (75 DF)	0.380 to 0.750 kg/ha 0.51 to 1.00 kg/ha	FOR USE ON CHERRIES ONLY Apply as a preplant incorporated treatment in the year of planting. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	67 g of CASORAN (4 G) applied to an area 2 x 2 m is equivalent to 175 kg/ha. Do not apply until 4 weeks after transplanting. Do not use on light, sandy soil.
	linuron[1] LOROX DF (50 DF) AFOLAN F (480 g/L)	4.500 kg/ha 9.00 kg/ha 9.36 L/ha	Apply in 400 to 600 L water per hectare as directed spray before weeds are 10 cm high. Use only under trees established for 10 years. Keep spray off leaves and green bark of trees.
Emerged annual and perennial weeds	glyphosate ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under apples section for remarks.
	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare, or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more. Under trees established at least 10 years, linuron can be tank mixed with paraquat to provide residual weed control.

[1] *LOROX L (480 g/L) equivalent is 9.0 L/ha*

GRAPES

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS

Hilling the vines at regular intervals throughout the year will aid in weed control. Be aware that this disruption of the soil will also disturb any residual herbicides. The use of cultivation, mulch or rye cover crops between the rows will provide better water penetration as well as aid in weed control.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply only to dormant healthy vines which have been established for at least 2 full years.

	diuron KARMEX (80 DF)	1.800 to 5.360 kg/ha 2.25 to 6.70 kg/ha	Apply in at least 300 L water per hectare actually sprayed. Apply as a directed spray to a 1 m strip under vines. Where weed growth is heavy, a rate of 4.5 kg/ha KARMEX (80 WP) is usually sufficient, except on heavy clay soils or on soils with a high organic matter content. Then the rate should be increased to 6.7 kg/ha. A maintenance application of 2.25 kg/ha KARMEX (80 WP) should be sufficient if applied before weed seeds germinate. Use only in vineyards established for at least 3 years. Applications may be made in the spring or fall or both, but the total amount applied in one year should not exceed 4.5 kg/ha KARMEX (80 WP), except on heavy clay or high organic matter soils as noted above.
	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. Use only under vines which have been established at least one year.
	simazine** PRINCEP NINE-T (90 WG) SIMADEX (500 g/L)	3.600 to 4.500 kg/ha 4.00 to 5.00 kg/ha 7.20 to 9.00 L/ha	Apply in at least 300 L water per hectare actually sprayed. Use only in vineyards established for at least 3 years. Established dandelions, field bindweed and quackgrass will not be controlled. Should control plantain.
Emerged weeds and grasses	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on vines established on trellises. Paraquat can be used in a tank mix with diuron.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.750 to 5.500 kg/ha 5.50 to 11.00 L/ha	Apply in 500 L water per hectare. See notes above for paraquat and simazine.
Bindweed, plantain and many emerged broadleaf weeds and grasses	paraquat GRAMOXONE (200 g/L) plus MCPB/MCPA (15:1) TROPOTOX PLUS (400 g/L)	1.100 kg/ha 5.50 L/ha 1.100 kg/ha 2.75 L/ha	Apply in 1000 L water per hectare or apply 55 mL GRAMOXONE plus 30 mL TROPOTOX PLUS in 10 L water per 100 m^2. Apply in late May or early June, or for bindweed control, when bindweed starts to bloom. MCPB/MCPA SPRAY OR DRIFT CAN INJURE GRAPES. Use only when necessary as a spot treatment. Use a hand sprayer or a hand controlled wand fitted with a shielded nozzle. Use a low pressure, coarse spray and direct spray to avoid contact with leaves and stems of grape vines.
Emerged annual weeds	glyphosate* ROUNDUP (356 g/L)	0.801 to 1.246 kg/ha 2.25 to 3.50 L/ha	Apply in 200 to 300 L water per hectare actually sprayed. Use preemergence herbicides to provide residual control of weed seedlings. DIRECT SPRAY TO AVOID LEAVES AND GREEN STEMS OF GRAPEVINES. Do not use on vines less than 3 years old. For handgun applications, use a 1% solution for quackgrass and annual weeds and a 2% solution for other perennials. Can be applied with wiper equipment. Refer to section on SELECTIVE WEED CONTROL WITH WIPER APPLICATORS. For SITE PREPARATION, refer to SPECIAL METHODS OF WEED CONTROL section.
Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	See notes on glyphosate above.
Perennial weeds including poison-ivy	glyphosate* ROUNDUP (356 g/L)	2.491 to 4.270 kg/ha 7.00 to 12.00 L/ha	See notes on glyphosate above.

	glyphosate* ROUNDUP (356 g/L) plus simazine PRINCEP NINE-T (90 WG)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha 2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See notes on simazine and glyphosate above, as well as "Notes on Chemicals" section.
Quackgrass, thistles bindweed and perennial weeds	dichlobenil CASORON (4 Gr)	7.000 to 9.000 kg/ha 175.00 to 225.00 kg/ha	Apply only to dormant, healthy vines that have been established at least two full years.

* *Additional products are available. See Table 1.*
** *SIMADEX (80 WP) equivalent rate is 4.5 to 5.5 kg/ha*

CAUTION: Diuron, napropamide and simazine residues, high enough to harm many crops, can persist for several years after the removal of the vineyard.

PEACHES

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	67 g CASORON (4 G) applied to an area 2 x 2 m is equivalent to 175 kg/ha. Do not apply until 4 weeks after transplanting. Do not use on light, sandy soil.
	linuron* LOROX DF (50 DF) AFOLAN F (480 g/L)	4.500 kg/ha 9.00 kg/ha 9.36 L/ha	Apply in 400 to 600 L water per hectare as a directed spray before weeds are 12 cm high. Use only under peach trees established for over one year. Keep spray off leaves, fruit and green bark of trees. Add a surfactant.
	metolachlor DUAL (960 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	APPLY ONCE IN THE YEAR OF PLANTING ONLY. Do not use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
	metribuzin LEXONE DF (75 DF)	0.375 to 0.750 kg/ha 0.50 to 1.00 kg/ha	Apply as a preplant incorporated treatment in the year of planting. Make a single application as a broadcast treatment or within the planting row. Consult label for incorporation instructions.
	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. Use only under trees established for at least one year.
	terbacil SINBAR (80 WP)	1.800 to 3.600 kg/ha 2.25 to 4.50 kg/ha	Apply in 1000 L of water per hectare. Use only under trees established for at least 3 years.
	simazine PRINCEP NINE-T (90 WG)	0.991 to 1.982 kg/ha 1.10 to 2.20 kg/ha	FOR TREES ESTABLISHED LESS THAN ONE YEAR. Apply once per season. See remarks above under APRICOTS section.

Emerged annual and perennial weeds	glyphosate* ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under APPLES section for remarks.
	linuron* LOROX DF (50 DF) AFOLAN F (480 g/L)	4.520 kg/ha 9.00 kg/ha 9.36 L/ha	Apply in 400 to 600 L water per hectare as a directed spray before weeds are 12 cm high. Use only under peach trees established for over one year. Keep spray off leaves, fruit and green bark of trees. Add a surfactant.
	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare, or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more. Paraquat may be used as a tank mix with linuron.

* *LOROX L (480 g/L) equivalent rate is 9.0 L/ha*

CAUTION: Terbacil, simazine and napropamide residues, high enough to harm many crops, can persist for several years after removing orchard.

PEARS

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Germinating weeds	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	67 g of CASORON (4 G) applied in an area 2 x 2 m is equivalent to 175 kg/ha. Do not apply until 4 weeks after transplanting. Do not use on light, sandy soils.
	linuron* LOROX DF (50 DF) AFOLAN F (480 g/L)	4.520 kg/ha 9.00 kg/ha 9.36 L/ha	Apply a directed spray before weeds are 10 cm high in 400 to 600 L water per hectare. Add a surfactant. Use only under pear trees established at least 10 years. Avoid contact with fruit, foliage or green bark with spray or drift.
	metolachlor DUAL (960 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.920 to 2.640 kg/ha 2.00 to 2.75 L/ha 0.990 to 1.980 kg/ha 1.10 to 2.20 kg/ha	APPLY ONCE IN THE YEAR OF PLANTING ONLY. Do not use on sandy soils with less than 2% organic matter. Apply post planting, pre-emergent to weeds, preferably after rain has settled the soil around the trees. Avoid contact with tree trunks and leaves.
	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. Use only under trees established for at least one year.
	simazine** PRINCEP NINE-T (90 WG) SIMADEX (500 g/L)	2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha 4.50 to 9.00 L/ha	Apply in 300 to 1000 L of water per hectare. Use only under trees planted for one year or more.
Emerged annual and perennial weeds	glyphosate* ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under APPLES and "Notes on Chemicals" sections for remarks.
	linuron* LOROX DF (50 DF) AFOLAN F (480 g/L)	4.500 kg/ha 9.00 kg/ha 9.36 L/ha	Apply a directed spray before weeds are 10 cm high in 400 to 600 L water per hectare. Add a surfactant. Use only under pear trees established at least 10 years. Avoid contact with fruit, foliage or green bark with spray or drift.

	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL in 10 L water sprayed to wet weed foliage. Use on trees established one year or more.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.750 to 5.500 kg/ha 5.50 to 11.00 L/ha	This commercial mixture can be used on emerged weeds and grasses to provide a quick knockdown of weeds as well as residual control for most of the growing season. Use only under trees established for a least one year.
	paraquat GRAMOXONE (200 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.100 kg/ha 5.50 L/ha 2.250 to 4.500 kg/ha 2.50 to 5.00 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
Emerged grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.250 to 0.500 kg/ha 1.00 to 2.00 L/ha	Use only under non-bearing pear trees. Apply to annual grasses at the 2 to 5 leaf stage at 1 L/ha. If quackgrass is present, apply 2 L/ha at the 3 to 5 leaf stage. AGRAL 90 to be applied at 1 litre in 1000 litres spray solution.
	propyzamide KERB (50 WP)	2.250 kg/ha 4.50 kg/ha	Use only under pear trees established for at least one year. 4.5 kg/ha is equivalent to 45 g/100 m^2.

* *LOROX L (480 g/L) equivalent rate is 9.0 L/ha*
** *SIMADEX (80 WP) equivalent rate is 4.5 to 5.5 kg/ha*

CAUTION: Simazine, napropamide and terbacil residues, high enough to harm many crops, may persist for several years after removal of the orchard.

Table 9. Fruit Crop Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent F - Fair
G - Good P - Poor

Treatment	Trade Name	Method of Application	CROP REGISTRATIONS: apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries	ANNUAL BROADLEAF WEEDS: chickweed, common	lamb's-quarters	mustards	pigweeds	ragweed	smartweed, lady's-thumb	ANNUAL GRASSES: barnyard grass	brome grass	crabgrass	fall panicum	sandbur	witch grass	PERENNIAL WEEDS: bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping-charlie)	mallow	milkweed	nightshade, climbing	nutsedge	quackgrass	plantains	poison-ivy	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
metribuzin	LEXONE	ppi	✓	✓		✓[1]				✓				E	E	E	E	E	G		G	G		G	P							P	P	P	P			P		P		
dichlobenil	CASORON	pre	✓		✓	✓		✓	✓	✓	✓	✓	E	E	E	E	E	E	G	P	F	F		G	P	G	G		P	F				G	G	G	P	G		G	G	

Table.9. Fruit Crop Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating:	E -Excellent	F - Fair
	G - Good	P - Poor

			CROP REGISTRATIONS										ANNUAL BROADLEAF WEEDS						ANNUAL GRASSES						PERENNIAL WEEDS																	
Treatment	**Trade Name**	**Method of Application**	apples	apricots	blackberries	cherries/plums	currants/gooseberries	grapes	highbush blueberries	peaches	pears	raspberries	chickweed, common	lamb's-quarters	mustards	pigweeds	ragweed	smartweed, lady's-thumb	barnyard grass	brome grass	crabgrass	fall panicum	sandbur	witch grass	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping-charlie)	mallow	milkweed	nightshade, climbing	nutsedge	quackgrass	plantains	poison-ivy	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
metolachlor + simazine	DUAL + PRINCEP NINE-T	pre	√[4]	√[4]		√[4]				√[4]	√[4]		E	E	E	E	E	E	E	E	G	G		E	P		P					P		P	F			P		P	P	
diuron	KARMEX	pre						√					E	E	E	E	E	E	G	F	G	F		F			F					P		P	P					P		
napropamide	DEVRINOL	pre	√		√			√		√	√	√	G	G	P	G	G	P	E	E	E	E		E			P							F	F	F	P				P	
linuron	LOROX	pre/early post	√			√				√	√		E	E	E	E	E	E	E		F	E		E	F	G						F		G	F			G		F		
linuron	AFOLAN F	pre/early post	√			√				√	√		E	E	E	E	E	E	E		F	E		E	F	G						F		G	F			G		F		
simazine	PRINCEP NINE-T	pre/early post	√	√	√			√	√	√	√	√	E	E	E	E	E	E	E	E	G	F		E	P		P					P		P	F			P		P	P	
simazine	SIMADEX	pre/early post	√	√	√			√		√	√	√	E	E	E	E	E	E	E	E	G	F		E	P		P					P		P	F			P		P	P	
terbacil	SINBAR	pre/early post	√						√	√			E	E	E	F	E	E	E	E	G	E	F	E		G	F					F		F	F	G		P		F	F	
amitrole	AMITROL-T	post	√													G						G							P			G		G	G		G	G		G	G	
fluazifop-butyl	FUSILADE	post	√[4]								√[4]		P	P	P	P	P	P	E	E	E	E		E	P	P	P	P	P	P	P	P	P	P	G	P	P	P	P	P	P	P
glyphosate	ROUNDUP[2]	post	√	√	√	√	√	√	√	√	√	√	E	E	E	E	E	E	E	E	E	E		E	E	E	F		G	F	F	E		F	E	E	E	G	F	E	F[3]	G
paraquat	GRAMOXONE	post	√	√	√	√	√	√	√	√	√	√	E	E	E	E	E	E	E	E	E	E		E	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]
propyzamide	KERB	post	√								√		G	F	G	P	F	G	E	E	E	E		E										P	G							
2,4-D	2,4-D[2]	post			√							√	P	G	E	E	G	G	P	P	P	P		P	F	P	E	P	F	P	P	P		P	P	E		G		G	F	

√ Indicates crop registration.

[1] For Cherries only.

[2] Additional products are available, see Table 1.

[3] Repeated treatments may provide control.

[4] Non-bearing trees only.

BERRY CROPS

BLUEBERRIES, HIGHBUSH

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

Cultural Weed Control-See notes on CULTURAL WEED CONTROL IN FRUIT & ORNAMENTALS section.

No herbicides are registered for preemergence weed control in the planting year. A biodegradable mulch could be used for weed control within the plant row. Sawdust mulch will assist in weed control if it is applied early in the season before the weed seeds germinate. Apply old sawdust 5 cm thick. The mulch will not prevent the germination of weed seeds that may blow onto the surface of the mulch.

In subsequent years, the organic matter in the mulch may tie up and thus reduce the effectiveness of certain residual herbicides.

The nitrogen requirements of the crop will change as the mulch is degraded. Initially, nitrogen will be consumed by microorganisms, thus necessitating higher rates of nitrogen fertilizer. Later, as the sawdust is degrading, nitrogen will be released and the crop may require less nitrogen fertilizer than an unmulched crop. It may take 2 years or more for sawdust mulch to significantly decompose. Adjust fertilizer rates according to mulch breakdown, plant growth and leaf nutrient analysis results.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	Refer to SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION section for remarks.
After Planting			
Germinating weeds	dichlobenil CASORON (4 Gr)	7.000 to 9.000 kg/ha 175.00 to 225.00 kg/ha	67 g CASORON (4 G) applied to an area 2 x 2 m is equivalent to 175 kg per hectare. Use only under plants established for at least 3 years. Do not use on light, sandy soil.
	simazine PRINCEP NINE-T (90 WG)	2.250 to 3.380 kg/ha 2.50 to 3.75 kg/ha	Apply in 300 to 1000 L water per hectare before weed emergence. Use only on established plants.
	terbacil SINBAR (80 WP)	2.200 to 3.400 kg/ha 2.75 to 4.25 kg/ha	Apply in 200 to 1000 L water per hectare. Use only in plantings established in the field for at least one year. Make one application per year. Injury may occur on sandy soil even with the low rate. Use the high rate only on muck or peat soils where experience has shown this to be a safe practice.
Emerged annual and perennial weeds	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL of product in 10 L of water sprayed to wet weed foliage. Use on plantings established one year.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.750 kg/ha 5.50 L/ha	Apply to established plantings only. Use a directed spray. See comments above on paraquat and simazine.

	paraquat GRAMOXONE (200 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.100 kg/ha 5.50 L/ha 2.250 to 3.380 kg/ha 2.50 to 3.75 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
Quackgrass and emerged annual weeds	glyphosate* ROUNDUP (356 g/L)	1.000 to 1.990 kg/ha 2.81 to 5.59 L/ha	Apply as a directed spray in 200 to 300 L water/hectare, using no more than 275 kPa pressure. Avoid contact with fruit, foliage or canes. Use only one application per season, no closer than 30 days to harvest.

* *Additional formulations available. See Table 1.*

CAUTION: Terbacil and simazine residues, high enough to harm many crops, can persist for several years after removal of a planting.

CANEBERRIES (Raspberries and Blackberries)

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION section for rates and remarks.
After Planting			
Germinating weeds and grasses	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. May be used on new or established plantings. Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit or foliage.
	simazine*** PRINCEP NINE-T (90 WG) SIMADEX (500 g/L)	1.800 to 2.250 kg/ha 2.00 to 2.50 kg/ha 3.60 to 4.50 L/ha	Apply in 300 to 1000 L of water per hectare actually sprayed. Apply as a directed spray early in the spring before the weeds emerge. Keep spray off young shoots. Do not use in first year plantings. Do not exceed recommended rate.
Emerged weeds and grasses	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL in 10 L water sprayed to wet weed foliage. Direct spray at base of canes in the spring before new shoots emerge.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	2.750 kg/ha 5.50 L/ha	This commercial mixture can be used only on established plantings to control emerged weeds and grasses and to provide residual control. Do not spray young raspberry shoots. See notes concerning simazine and paraquat above.
	paraquat GRAMOXONE (200 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.100 kg/ha 5.50 L/ha 1.800 to 2.250 kg/ha 2.00 to 2.50 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.

Emerged broadleaf weeds	2,4-D* 2,4-D (500 g/L)	0.550 kg/ha 1.10 L/ha	Use the amine formulation. Apply in 100 to 200 L of water per hectare actually sprayed. Do not spray when plants are in bloom. Keep spray off new shoots as much as possible. Spot spraying at a rate equivalent to 1 kg/ha may be necessary to control established dandelions and other broadleaf weeds.
Quackgrass, perennial and annual weeds	dichlobenil CASORON (4 Gr)	7.000 kg/ha 175.00 kg/ha	Apply on established raspberry plantings in late fall. Do not cultivate or work into the soil. DO NOT APPLY IN THE SPRING as injury may result.

* *Additional formulations are available. Use rates to give comparable amounts of active ingredient. See Table 1.*

** *SIMADEX (80 WP) equivalent rate is 2.25 to 2.75 kg/ha*

CRANBERRIES

Maintaining a healthy and vigorous crop will aid in weed control by avoiding openings in the bed for weed germination and establishment.

Prevent weeds from setting seed on dikes and in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from setting seed. Seeding the dikes with a desirable grass cover will reduce the opportunities for weed establishment and will provide bank stabilization.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
After Planting			
Annual broadleaf species, certain sedges and *Juncus* species	dichlobenil CASORON (4 Gr)	4.400 kg/ha 110.00 kg/ha	Apply in early spring, pre-bloom. Temporary reddening of plants may occur, especially with late spring applications. Do not use on young beds or on newly sanded beds or on beds recently mowed for vines. Use lower rates of applicaton on sandy bogs.
Emerged annual and perennial weeds	glyphosate* ROUNDUP (356 g/L)	0.356 kg/4 L water 1.00 L/4 L water	Use a 20% solution. Apply with a rope wick or other similar device. Refer to section on SELECTIVE WEED CONTROL WITH WIPER APPLICATORS. Avoid contact with the cranberry vines.

* *Additional products are available. See Table 1*

CURRANTS AND GOOSEBERRIES

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

Cultural Weed Control - See notes on CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

There are no herbicides registered for preemergence weed control in currents and gooseberries. A biodegradable mulch could be used for weed control in the planting strip. A straw mulch will assist in weed control within the row if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the crop.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.800 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION for remarks.
After Planting			
Emerged weeds and grasses	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL of water as a spot treatment, sprayed to wet weed foliage. Direct the spray to wet the weeds but avoid wetting the leaves or green bark of the bushes.

RASPBERRIES AND BLACKBERRIES See CANEBERRIES

STRAWBERRIES

NOTE: Recommended rates per hectare refer to area actually treated with herbicide.

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

Use straw mulch which is free of weed seed in strawberries so that weeds are not imported into the crop. The mulch should be spread between the rows when it is pulled off the plants in the spring to provide additional weed control.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate* ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS OF WEED CONTROL - SITE PREPARATION section for remarks.
Germinating annual grasses, lamb's-quarters and pigweed	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L)	0.600 to 1.148 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.20 L/ha	Apply preemergence to the weeds or following a clean cultivation. May be applied and incorporated up to 3 weeks before planting. Incorporation is essential. May delay establishment under stressful conditions.
Planting Year - 2 to 6 weeks after planting			
Germinating weeds	chlorthal dimethyl DACTHAL WP (75 WP)	8.835 to 10.714 kg/ha 11.75 to 14.25 kg/ha	Apply preemergence to the weeds or following a clean cultivation. Shallow cultivation to incorporate chemical into soil surface may improve weed control. Do not apply more than three applications during the planting year.

	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Apply preemergent to weeds or following a cultivation. Incorporation by cultivation or rainfall or irrigation is essential. Where daughter plant establishment is important, (e.g., for plant producers) delay application until desired number of daughter plants have been established. Inhibition of daughter plant roots can occur where soil moisture is low and will be minimized if irrigation is applied shortly after application. See "Notes on Chemicals" section.
Emerged broadleaf annual seedlings	2,4-D* 2,4-D (500 g/L)	0.550 kg/ha 1.10 L/ha	Use the amine formulation. Apply in 100 to 200 L of water per hectare. Use low pressure and a coarse spray to minimize risk of spray drift to susceptible crops. Do not use while early runners are rooting, or between mid-August and fall dormancy when flower buds are developing for next year's crop.
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. Use only one application per season. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

* *Additional formulations are available. Use rates to give comparable amounts of active ingredients. See Table 1.*

Planting Year - 4 to 6 weeks after planting

Germinating and seedling weeds	terbacil SINBAR (80 WP)	0.220 to 0.440 kg/ha 0.28 to 0.55 kg/ha	Apply in at least 300 L water per hectare when mother plants are well established but before runnering becomes extensive and new runner plants are rooting. Apply preemergence or early postemergence to the weeds. Use lower rate on sandy soils low in organic matter and on sensitive varieties such as Earlidawn, Midway, Micmac, Bounty and Kent, since they may be severely injured. This treatment may severely injure weak or diseased plants of any variety. Accurate calibration of sprayer is essential to avoid crop injury. Do not overlap spray swaths. Shallow cultivation can be done to train runners and control escaped weeds without destroying the effectiveness of terbacil.

Late Summer and Fall-Planting and Harvesting Years

Germinating weeds	chlorthal dimethyl DACTHAL WP (75 WP)	8.835 to 10.714 kg/ha 11.75 to 14.25 kg/ha	Apply preemergence to the weeds, following clean cultivation.
	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface. Do not apply during harvest period. Do not apply more than once per season.
Germinating & seedling weeds	terbacil SINBAR (80 WP)	0.144 to 0.220 kg/ha 0.18 to 0.28 kg/ha	Apply in at least 300 L water per hectare, preemergence or early postemergence to the weeds. See remarks on terbacil above.
Emerged quackgrass, annual grasses, volunteer wheat, and barley seedlings	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. Use only one application per season. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

Late Fall - Planting and Harvesting Years			
Wheat, winter annuals and weeds germinating in early spring	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface just prior to mulching, but not on frozen ground. Do not apply more than once per season.
	terbacil SINBAR (80 WP)	0.560 to 0.680 kg/ha 0.70 to 0.85 kg/ha	Apply in at least 300 L water per hectare just prior to mulching. Use low rate where it is planned to use terbacil again in the spring. See remarks on terbacil above.
Tufted vetch, Canada thistle, sheep sorrel and ox-eye daisy	clopyralid LONTREL (200 g/L)	0.200 to 0.300 kg/ha 1.00 to 1.50 L/ha	Apply with a boom sprayer in 150-250 L/ha of water. Apply as a single treatment prior to mulching in October/November on new and established plantings. Preharvest interval is 200 days.
Spring - Harvesting Years			
Germinating weeds	chlorthal dimethyl DACTHAL WP (75 WP)	8.835 to 10.714 kg/ha 11.75 to 14.25 kg/ha	Apply preemergence to the weeds, immediately after removing the mulch.
	napropamide DEVRINOL 50W (50 WP)	4.500 kg/ha 9.00 kg/ha	Incorporation by rainfall or irrigation is essential - see "Notes on Chemicals" section. Apply to a weed free soil surface just after mulch is removed, but not on frozen ground. Do not apply from bloom to harvest. Do not apply more than once per season.
Germinating and seedling weeds	terbacil SINBAR (80 WP)	0.220 to 0.280 kg/ha 0.28 to 0.35 kg/ha	Apply in at least 300 L water per hectare immediately after mulch is removed. If strawberry plants have made weak yellow growth under the mulch, wait 5-7 days until plants recover before applying terbacil. See remarks on terbacil above.
Emerged quackgrass, annual grasses, volunteer wheat, and barley seedlings	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. Use only one application per season. Apply before bloom. Preharvest interval is 30 days. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
After-Harvest Renovation			
Dandelions and other broadleaf weeds	2,4-D* 2,4-D (500 g/L)	1.100 kg/ha 2.20 L/ha	Use amine formulation. Apply after harvest but before mowing to control dandelions and other broadleaf perennials. Delay mowing for a few days after application. Do not apply 2,4-D between mid August and fall dormancy because of its possible effect on flower bud formation. Veestar is more sensitive to 2,4-D than Redcoat.
Germinating weeds	chlorthal dimethyl DACTHAL WP (75 WP)	8.835 to 10.714 kg/ha 11.75 to 14.25 kg/ha	Apply preemergence to the weeds after mowing and narrowing the rows.
Germinating and seedling weeds	terbacil SINBAR (80 WP)	0.560 to 0.680 kg/ha 0.70 to 0.85 kg/ha	Apply in at least 300 L water per hectare preemergence or early postemergence to the weeds. If, 2,4-D was used prior to mowing, delay applying terbacil for at least 2 weeks. See remarks on terbacil above.

Emerged quackgrass, annual grasses and volunteer wheat and barley seedlings	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2 L product/ha) when quackgrass is present. Use only one application per season. Some annual grasses such as foxtail may not be controlled with this application to regrowth. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
Tufted vetch, Canada thistle, sheep sorrel and ox-eye daisy	clopyralid LONTREL (200 g/L)	0.200 to 0.300 kg/ha 1.00 to 1.50 L/ha	Apply with a boom sprayer in 150 to 250 L/ha of water. Apply as a single treatment immediately after harvest at renovation before mowing on new and established plantings. Pre-harvest interval is 200 days.

* *Additional formulations are available. Use rates to give comparable amounts of active ingredient. See Table 1.*

CAUTION: Residues high enough to harm some crops can persist in the soil for over a year after using TERBACIL and NAPROPAMIDE. Residues are likely to be higher on heavier soil types.

Table 10. Strawberry Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E -Excellent G - Good		F - Fair P - Poor	PRODUCTION TIME			ANNUAL BROADLEAF WEEDS									ANNUAL GRASSES							PERENNIAL WEEDS															
Treatment	Trade Name	Method of Application	preplanting	planting year	harvesting years	chickweed, common	groundsel	lamb's-quarters	mustards	pigweeds	ragweed	smartweed, lady's-thumb	snapdragon, dwarf	violet, field (field pansy)	barnyard grass	brome grass	crabgrass	fall panicum	foxtails	witch grass	volunteer grains	bindweeds	chickweed, mouse-eared	daisy, ox-eye	dandelion	ground-ivy (Creeping Charlie)	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sorrel, sheep	sow-thistle	thistle, Canada	toadflax, yellow	vetches
trifluralin	TREFLAN, RIVAL	preplant inc.	√			G	P	G	P	G	P	P			E		E	E	E	E	E	P	F	P	P	P	P	P	P	P	P	P	P	P	P	P	P
glyphosate	ROUNDUP[1]	post (preplant)	√			E		E	E	E	E	E			E	E	E	E	E	E	E	E	E		F	F	F	E	P	E	E	E	G	G	E	G	F[2]
chlorthal dimethyl	DACTHAL	pre		√	√	G	P	G	P	G	P	P	G	G	G		G	G	G	G	G		G	P	G				P	P		P					
napropamide	DEVRINOL	pre		√	√	G	G	G	P	G	G	P	P	P	E	E	E	E	E	E	E				P					F			P				P
terbacil	SINBAR	pre/early post		√	√	E[2]	F	E[2]	E[2]	G[2]	E[2]	E[2]	P	F[2]	E	E	G	E	E	E	E			P	F			F	F	G		F	G		F	P	P
2,4-D	2,4-D*	post		√	√	P	F	G	E	E	E	G	P	P	P	P	P	P	P	P	P	F	P	P	E	P	P	P	P	E		P	G		G		F
paraquat	GRAMOXONE	post		√	√	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]	P[3]

Table 10. Strawberry Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent, G - Good, F - Fair, P - Poor

			PRODUC-TION TIME			ANNUAL BROADLEAF WEEDS									ANNUAL GRASSES							PERENNIAL WEEDS															
Treatment	Trade Name	Method of Application	preplanting	planting year	harvesting years	chickweed, common	groundsel	lamb's-quarters	mustards	pigweeds	ragweed	smartweed, lady's-thumb	snapdragon, dwarf	violet, field (field pansy)	barnyard grass	brome grass	crabgrass	fall panicum	foxtails	witch grass	volunteer grains	bindweeds	chickweed, mouse-eared	daisy, ox-eye	dandelion	ground-ivy (Creeping Charlie)	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sorrel, sheep	sow-thistle	thistle, Canada	toadflax, yellow	vetches
clopyralid	LONTREL	post		√	√	P	G				F				P	P	P	P	P	P	P	P	P	G	G	P	P	P	P	P	P	P	G	G[4]	E	P	E
fluazifop-butyl	FUSILADE	post		√	√	P	P	P	P	P	P	P	P	P	E	E	E	E	G	E	E	P	P	P	P	P	P	P	P	P	P	G	P	P	P	P	P

* *Various formulations are available, see Table 1.*

√ *Indicates production time when product can be used.*

[1] *Additional products available, see Table 1.*

[2] *Low rates and single applications may provide less control.*

[3] *Repeated treatments may provide control.*

[4] *Top growth only; regrowth can be expected.*

HERBACEOUS ORNAMENTALS

NOTE: To convert kg or L/ha to g or mL/100 m^2 multiply by 10 (example: 11 kg/ha becomes 110 g/100 m^2 and 28.4 L/ha becomes 284 mL/100 m^2).

WARNING: Certain species may be injured by the following herbicides. Check manufacturer's directions for labelled species before use.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION section for rates and remarks.

Preplant Incorporated			
Germinating seeds	trifluralin TREFLAN (545 g/L)	0.601 to 1.148 kg/ha 1.10 to 2.10 L/ha	Trifluralin must be incorporated before transplanting. Do not use for seeded annuals. Check label for list of tolerant species.
Preemergence			
Seedling annuals and germinating seeds	chloramben GARDEN WEED PREVENTER (4 Gr)	4.400 kg/ha 110.00 kg/ha	Chloramben is applied as a granular formulation to weed free areas around established plants. Check label for list of tolerant ornamental plants.
	chlorthal dimethyl DACTHAL WP (75 WP) DACTHAL GR (5 Gr)	6.767 to 12.406 kg/ha 9.00 to 16.50 kg/ha 140.00 to 250.00 kg/ha	Apply the wettable powder in 150 to 300 L water per hectare before weed emergence. Use only around established transplants.
Postemergence			
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

CAUTION: Certain species may be injured by the above herbicides. Check manufacturer's directions for labelled species before use.

HERBACEOUS ORNAMENTALS - GLADIOLI

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION section for remarks.
Preemergence			
Seedling annuals and germinating seeds	chlorthal dimethyl DACTHAL WP (75 WP) DACTHAL GR (5 Gr)	6.767 to 12.406 kg/ha 9.00 to 16.50 kg/ha 140.00 to 250.00 kg/ha	Apply preemergence for annual grass control.
	chloramben GARDEN WEED PREVENTER (4 Gr)	4.400 kg/ha 110.00 kg/ha	This granular formulation is available for the home gardener.

Preemergence or Postemergence to Crop			
Seedling annuals and germinating seeds	chlorpropham CIPC EC (480 g/L) CIPC (20 Gr)	5.577 kg/ha 11.60 L/ha 27.50 kg/ha	May be applied either preemergence or postemergence to the gladioli. When used postemergence apply as a directed spray or use the granular formulation. Particularly effective against purslane. Apply after a clean cultivation, when the soil is moist, in 200 to 400 L water per hectare.

HERBACEOUS ORNAMENTALS - IRIS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATIONS section for rates and remarks.
Postemergence to Crop, Preemergence to Weeds			
Seedling annuals and germinating seeds	chloramben GARDEN WEED PREVENTER (4 Gr)	4.400 kg/ha 110.00 kg/ha	Granular formulation suitable for the home garden trade. Apply after a clean cultivation when the leaves of the iris plants are dry.
Postemergence to Crop and Weeds			
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

SHELTERBELTS (WINDBREAKS)

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

SHELTERBELTS (WINDBREAKS) ESTABLISHED

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preemergence Preemergence Incorporated			
Germinating annual weeds	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply in early spring or late fall. Use the lower rate for spring application. Check label for tolerant species. Reduce rates on lighter soils.
	simazine PRINCEP NINE-T (90 WG)	2.252 to 3.378 kg/ha 2.50 to 3.75 kg/ha	Apply in the fall or spring prior to weed emergence or after emerged weeds have been removed. Windbreak species must be established for at least one year. Tolerant species include cedar, spruce, black walnut, white ash, green ash, elm, boxelder, maple and caragana. Check label for species which will tolerate higher rates of simazine. Apply before buds break in spring. Use low rate for sandy soils or low organic matter soils.
	trifluralin TREFLAN (545 g/L)	0.601 to 1.148 kg/ha 1.10 to 2.10 L/ha	Apply as a directed spray to the soil surface around the trees or shrubs. Incorporate as closely as possible to the trees and shrubs without causing damage to their roots.
Quackgrass	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply in the late fall (October 15 to December 15) as a granular application. Tolerant species include cedar, linden, maple, willow, caragana and ash.
Postemergence			
Emerged annual weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 1.245 kg/ha 2.25 to 3.50 L/ha	Apply in 200 to 300 L water per hectare. Apply to actively growing weeds as a directed spray. Remove all suckers from base of trunks before application. Do not allow spray or spray drift to contact leaves or green bark of trees. Use preemergence herbicide to provide residual control of weed seedlings (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section). Applications may be made where the following species are grown: ash, caragana, cherry, elm, lilac, maple, mountain ash, poplar, Russian olive, willow, pine, spruce, fir or yew.
Quackgrass	glyphosate ROUNDUP (356 g/L)	1.690 to 2.490 kg/ha 4.75 to 7.00 L/ha	See remarks above. For quackgrass control, apply when grass has at least 3 to 4 new leaves.
Perennial weeds	glyphosate ROUNDUP (356 g/L)	2.491 to 4.270 kg/ha 7.00 to 12.00 L/ha	See remarks above. Canada thistle should be at least in early bud, milkweed at bud and bindweed at full flower for best results.
Emerged annual and perennial weeds	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Apply in 1000 L water per hectare or apply 55 mL in 10 L of water sprayed to wet weed foliage. More than one treatment may be necessary during the season since paraquat leaves no residue on the soil.
	paraquat/ simazine (1:4) TERRAKLENE (500 g/L)	7.000 to 8.500 kg/ha 14.00 to 17.00 L/ha	This commercial mixture can be used after weeds have emerged to provide quick knockdown of weeds as well as residual control for most of the growing season. Use only under trees established for at least one year. Apply in 500 L water per hectare. Applications may be made to the following species: caragana, green ash,

			Siberian and Amercian elm and boxelder maple. Injury may occur to trees growing on saline soils.
	paraquat GRAMOXONE (200 g/L) plus simazine PRINCEP NINE-T (90 WG)	1.100 kg/ha 5.50 kg/ha 2.252 to 3.378 kg/ha 2.50 to 3.75 kg/ha	This tank mix will provide knockdown of emerged weeds and residual control of germinating weeds. See remarks on paraquat and simazine above, as well as "Notes on Chemicals" section.
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

SHELTERBELTS (WINDBREAKS) TRANSPLANTED

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other emerged weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION section for rates and remarks.
Preplant Incorporated			
Germinating annual grasses, lamb's-quarters, pigweed, chickweed and purslane	trifluralin TREFLAN (545 g/L)	0.600 to 1.148 kg/ha 1.10 to 2.10 L/ha	Apply after a clean cultivation, and incorporate after application. Transplant the trees or shrubs so that most of their root system is placed below the treated layer of soil.
Postemergence			
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L product/ha) when quackgrass is present. AGRAL 90 to be applied 1 litre to 1000 litres spray solution.

TURF ESTABLISHMENT

When it is desired to establish turfgrass in areas that are heavily infested with weeds such as quackgrass, the areas should be treated with glyphosate (ROUNDUP) prior to the preparation of the seedbed.

Use glyphosate (ROUNDUP) at 1.7 to 2.5 kg (active) or 4.75 to 7.0 L/ha (product) in 200 to 300 L water per hectare or glyphosate (EXPEDITE GRASS AND & WEED) at 1.7 to 2.5 kg (active) or 11.5 to 17.0 L/ha (Ready-to-use product) applied postemergence when quackgrass is actively growing and has at least four leaves. Allow 7 or more days after application before tillage. For maximum quackgrass control, a repeat treatment may be necessary before grass establishment. If retreatment is necessary, wait until quack grass has reached the 3 to 4 leaf stage. For other perennial weeds, follow label instructions for proper rate and stage of growth.

TURFGRASS (LAWNS, PARKS AND GOLF COURSES)

NOTE: To convert kg or L/ha to g or mL/100m^2 multiply by 10 (example: 11 kg/ha becomes 110 g/100 m^2 and 28.4 L/ha becomes 284 mL/100 m^2).

The major species of broadleaf weeds infesting lawns in Ontario are dandelion, plantain, black medick, chickweed, prostrate knotweed, mallow, henbit, ground-ivy, and white clover. The major grassy weeds are crabgrass, annual bluegrass, quack grass, orchard grass and bentgrass.

One of the primary ways that a weed free lawn can be maintained easily, cheaply, and with a minimum of effort, is through an effective lawn maintenance strategy which takes advantage of the vigorous growth of a turfgrass, and therefore is the key to keeping lawn areas free of weeds. Most weeds cannot compete in a dense, healthy turf, so the maintenance of such a stand is of primary importance in producing a weed free area. Practices that tend to encourage vigorous grass growth will discourage weed infestations. Such practices include proper irrigation and/or drainage, use of fertilizers, insect and disease control, and the use of the correct type of turfgrass for the situation.

Mowing is beneficial because it stimulates bud development and tillering, inducing the sod to become thick and dense. Commonly grown grasses such as the fescues, bluegrasses and turf type perennial ryegrasses should be cut at a height of 4 to 6 cm. If grasses are cut shorter than this, invasion by weeds may occur. Avoid scalping the turf when cutting around trees and flower beds and do not remove more than one-third of the leaf area when mowing. Mowing too frequently may reduce the carbohydrate reserves of the turf, thereby reducing its competitiveness. Mowing can also be used to remove annual weeds and eliminate seed production, thereby reducing or preventing the spread of weeds.

Fertilizer is particularly important in establishing a thick, dense, and healthy turf sward. Too few nutrients applied to the sod will lead to increased susceptibility to disease and insects and the root system of the turf will not develop, leading to an inability of the grass to withstand traffic and recover from injury. Too much fertilizer may lead to soft, weak grass that is prone to disease damage.

Watering is particularly important during periods of drought that may injure, kill or induce dormancy in the turf, thereby allowing weeds to become established. Irrigation should be carried out at weekly intervals with about 3 cm of water per application to help produce deep rooted turf. Frequent light sprinkling will have the opposite effect on the grass roots. Light water applications encourage the germination and growth of shallow rooted species such as crabgrass and creeping bentgrass. Too much irrigation water will lead to infestations by yellow nutsedge and annual bluegrass. Therefore, it is important to install adequate drainage to ensure that waterlogging does not occur. Remember to provide adequate watering near trees and hedges because they compete for available moisture.

Compaction brought about by excessive traffic will often result in invasion by knotweed and annual bluegrass. Aeration practices will help in these situations but the best answer is to modify the area to reduce heavy traffic. Immediate resodding or reseeding of damaged areas will help to discourage weed infestations.

Use of the best turfgrass species for a given situation is very important. For example, fescues are tolerant to low light intensity in shaded areas under trees, whereas turf type perennial ryegrass varieties are quick to establish in newly seeded areas and will crowd out germinating weeds. Kentucky bluegrass, although slow to establish, is very competitive once established.

Provided weed populations are not too high, weeds can be removed by hand pulling or with a knife or V-shaped spudding tool. The reader is referred to other publications on these subjects from Agriculture Canada and the Ontario Ministry of Agriculture and Food (see address located near the end of this publication).

Chemical weed control is often the easiest, most effective and cheapest way to control annual and perennial weeds when populations are very high. The 2,4-D spray is most effective in the spring, or in September when the weeds are growing well. The treatment will generally thin Dutch clover in the lawn. Mecoprop, dichlorprop, and dicamba will control a number of weeds resistant to 2,4-D. As with 2,4-D, a thorough wetting of the weed foliage is emphasized. Mecoprop, dichlorprop and dicamba are also sold in mixtures with 2,4-D. Mecoprop is generally safer to use on bentgrass than 2,4-D.

Mixtures containing dicamba should not be used close to shrubs, etc., at rates above 0.425 kg (active) per hectare. Prepared mixtures of this chemical and 2,4-D are effective in a wide range of lawn weed species, including knotweed which is resistant to most other herbicides except when very young. After seeding new turf, many annual weeds may emerge before the grass seedlings are up. If these young weeds are not controlled, they will shade and eventually crowd out much of the grass population. Mowing at a height of 6 to 8 cm will eliminate many such weeds. If they are extrememly thick, 2,4-D at one-half the usual concentration (1.1 kg in 800 L water/ha) or mecoprop (1.1 kg in 400 L water/ha) can be used - but not before the grass had been up at least 4 weeks.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's purse, smartweeds, vetch. More resistant weeds include chickweeds, clovers, black medick and knotweed	2,4-D* 2,4-D (500 g/L) in	0.800 to 1.400 kg/ha 1.60 to 2.80 L/ha 200.00 to 400.00 L water/ha	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass unless necessary, and then only a 0.28 kg/ha. Some yellowing of bentgrass may occur.
Will control most broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and knotweed when young. Will not adequately control plantain in most situations.	dicamba* BANVEL 480 (480 g/L) in	0.600 kg/ha 1.25 L/ha 200.00 to 400.00 L water/ha	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass at 0.6 kg/ha but may be applied at lower doses when mixed with phenoxy herbicides. Do not apply near shallow rooted perennials because dicamba can be taken up by the roots of these plants. Pure dicamba is recommended for use in certain situations only; it is best when mixed at low use rates with phenoxy herbicides.
Dandelion, field horsetail, lamb's-quarters, mustards, plantains, shepherd's purse, wild carrot. More resistant weeds include chickweeds, clovers and black medick	MCPA* ESTAMINE MCPA (500 g/L) in	1.100 to 1.400 kg/ha 2.20 to 2.80 L/ha 200.00 to 400.00 L/100 m^2	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass unless necessary, and then only at 0.28 kg/ha. Some yellowing of bentgrass may occur. MCPA can be used as a substitute for 2,4-D. At slightly higher doses than 2,4-D it will usually provide as good weed control at 2,4-D. Control of dandelion and plantain may not be as good as with 2,4-D during dry, hot weather.
Spectrum of weed control is not as broad as with 2,4-D, dicamba, or MCPA. However, many 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground ivy and black medick can be controlled with mecoprop	mecoprop* COMPITOX (150 g/L) in or in	0.800 to 1.300 kg/ha 5.34 to 8.67 L/ha 200.00 to 400.00 L water/ha 60.00 to 90.00 mL 5.00 to 10.00 L/100 m^2	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. May be applied to bentgrass. Apply before flower to dandelion. Repeated applications may be required for complete control of dandelion and black medick.
Will control most broadleaf weeds, including 2,4-D tolerant weeds such as chickweeds, clovers, creeping charlie, black medick, and knotweed when young	dicamba* BANVEL 480 (480 g/L) plus 2,4-D 2,4-D (500 g/L) in	0.600 kg/ha 1.25 L/ha 0.550 to 1.100 kg/ha 1.70 to 2.20 L/ha 200.00 to 400.00 L water/ha	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass. Provides broader spectrum weed control than 2,4-D or dicamba applied alone (see precautions under dicamba).

	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L) in	1.650 kg/ha 2.84 L/ha 200.00 to 400.00 L water/ha	
Will control most broadleaf weeds, including 2,4-D tolerant weeds ;such as chickweeds, clovers, creeping charlie and black medick	2,4-D* 2,4-D (500 g/L) plus mecoprop* MECOPROP (150 g/L)	0.850 to 1.100 kg/ha 1.70 to 2.20 L/ha 0.850 to 1.100 kg/ha 5.67 to 7.34 L/ha	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and or mow until at least 24 hours after applications. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass. Provides broader spectrum weed control than 2,4-D or mecoprop applied alone. May be combined with dicamba (100 g ai/ha; 208 mL product) for control of young knotweed.
	mecoprop/ 2,4-D (1:1)* MECOTURF PLUS 2,4-D ((1:1) 400 g/L) in or in	1.700 to 2.200 kg/ha 4.25 to 5.50 L/ha 200.00 to 400.00 L water/ha 40.00 to 50.00 mL 3.00 to 8.00 L/100 m^2	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after appliction. Do not apply to newly seeded lawns until after second mowing. Do not apply to bentgrass. Provides broader spectrum weed control than 2,4-D or mecoprop applied alone. May be combined with dicamba (100 g ai/ha; 208 mL product) for the control of young knotweed.
Will control most broadleaf weeds, including 2,4-D tolerant weeds; such as chickweeds, clovers, creeping charlie and black medick	mecoprop/ 2,4-D EXPEDITE BROADLEAF ((1:2) 186 g/L)	1.765 to 2.603 kg/ha 9.50 to 14.00 L/ha	EXPEDITE BROADLEAF herbicides are ready-to-use products which must be applied with the EXPEDITE APPLICATION SYSTEM.
Will control most broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clovers, black medick, ground ivy, and knotweed when young	2,4-D/ dicamba/ mecoprop* KILLEX (308 g/L) in or in	1.700 kg/ha 5.50 L/ha 200.00 to 400.00 L 60.00 mL 5.00 to 10.00 L/m^2	Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. Do not irrigate, rake, and/or mow until at least 24 hours after application. Do not apply to newly seeded lawns until after second mowing. In closely mowed bentgrass (greens) it can be used only at half doses (30 mL/100 m^2). Temporary yellowing of bentgrass may occur. Recovery from injury will occur one week after application (see precautions under dicamba).
Crabgrass	bensulide* BETASAN (480 g/L) BETASAN (12.5 GR)	11.000 to 16.610 kg/ha 23.00 to 34.60 L/ha 88.00 to 132.00 kg/ha	Apply before crabgrass emergence in early spring, or in fall to established turf. Use the higher rate for fall application only if no reseeding has been done in the fall.
	chlorthal dimethyl DACTHAL WP (75 WP) DACTHAL (2.3 Gr)***	11.655 to 20.300 kg/ha 15.50 to 27.00 kg/ha 504.02 to 882.04 kg/ha	Same comment applies as for "bensulide" above.
	siduron TUPERSAN	9.000 to 13.500 kg/ha	Crabgrass may be controlled in a newly seeded area by applying siduron (TUPERSAN) at 6.75 kg (active) per hectare. This chemical must be applied after seeding but preemergence to the crabgrass seedlings. Apply only in early spring. Follow manufacturer's directions especially when applying to certain bentgrass strains. Available as fertilizer mix only.

Annual bluegrass ((*Poa annua*	bensulide* BETASAN (480 g/L) BETASAN (12.5 G)	13.655 to 16.635 kg/ha 28.40 to 34.60 L/ha 108.00 to 132.00 kg/ha	Repeated treatments will be required. Reseeding the area will not be possible for one year following treatment.
	chlorthal dimethyl* DACTHAL WP (75 WP) DACTHAL (2.3 Gr)	11.655 to 20.300 kg/ha 15.50 to 27.00 kg/ha 504.02 to 882.04 kg/ha	Same comment applies here as for "bensulide" above.
Emerged yellow nutsedge	bentazon BASAGRAN (480 g/L) plus ASSIST oil concentrate	0.840 kg/ha 1.75 L/ha 2.000 L/ha	Top growth of nutsedge is controlled by 2 applications 10 days apart.

* *Additional products are available. See Table 1*

** *DACTHAL 5.0 G use 232 to 406 kg/ha*

TURFGRASS RENOVATION

The turf to be renovated should be mowed and thoroughly raked to remove all dead and cut vegetation. Apply paraquat (GRAMOXONE) at a rate of 2.0 kg (active) or 10 L (product) in 1,000 L water per hectare. This treatment will "burn off" all emerged vegetation. When the old turf is dead, rotovate top 5 cm to cover dead grass, rake the surface to prepare seedbed and reseed.

Apply glyphosate (ROUNDUP) at 1.7 to 2.5 kg (active) or 4.75 to 7.0 L/ha (product) in 200 to 300 L water per hectare or glyphosate (EXPEDITE GRASS & WEED) at 1.7 to 2.5 kg (active) or 11.5 to 17.0 L/ha (Ready-to-use product) after omitting at least one regular mowing. Tillage should be delayed 7 days after application to allow for proper translocation into underground plant parts. Direct seeding into the killed turf (no tillage) may be carried out.

TURFGRASS RETARDATION

Reduction in grass growth may be brought about by treatment with maleic hydrazide (Royal MH 60 SG, 6.5 to 8.0 kg/ha product). Manufacturer's directions should be followed carefully. This chemical is recommended for use in areas where mowing and trimming are difficult and where a lawn like appearance is not necessary (see "Notes on Chemicals" section).

WOODY NURSERY STOCK - FIELD GROWN NURSERY STOCK

Cultural Weed Control - See CULTURAL WEED CONTROL IN FRUIT AND ORNAMENTAL CROPS section.

Mechanical weed control such as cultivation and hand hoeing will provide weed control in sensitive species as well as provide control of weed escapes. Cultivators are available which will work in between trees and in the row.

Warning: Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labelled species/cultivars before use.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preplant			
Quackgrass and many other emerged weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 4.270 kg/ha 2.25 to 12.00 L/ha	See under SPECIAL METHODS FOR WEED CONTROL - SITE PREPARATION section for rates and remarks.
Preplant Incorporated			
Seedling annuals and germinating weeds	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.150 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.30 L/ha 1.50 to 2.75 L/ha	Must be incorporated immediately after application, after a clean cultivation. This treatment does not control ragweed, annual nightshade or mustards, and lady's-thumb may also escape the treatment. Annual grass control is usually excellent. Use the lower rate on light soils.
Preemergence Preemergence Incorporated after plant			
NOTE: WARNING: Refer to manufacturers instructions for waiting period required after planting.			
Seedling annuals and germinating seeds	chlorpropham CIPC (20 Gr)	6.800 to 11.000 kg/ha 34.00 to 55.00 kg/ha	Apply the granular formulation after a clean cultivation when the soil is moist. CIPC should not be used on tree fruit nursery stock.
	chloramben GARDEN WEED PREVENTER (4 Gr)	4.400 kg/ha 110.00 kg/ha	Apply preemergence to the weeds when the soil is warm and moist.
	chlorthal dimethyl DACTHAL WP (75 WP)	9.022 to 16.541 kg/ha 12.00 to 22.00 kg/ha	Apply preemergence for annual weed control.
	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply in late fall or early spring. Use lower rate for spring application. Do not apply until 4 weeks after transplanting second year stock. Reduce rate on lighter soil.
	napropamide DEVRINOL 50W (50 WP) DEVRINOL 10G (10 Gr)	4.500 kg/ha 9.00 kg/ha 45.00 kg/ha	Apply any time of the year to a clean cultivated soil surface or before weeds germinate. Use only once prior to or during a growing season. Napropamide must reach the zone of weed germination, either by mechanical incorporation or by adequate irrigation or precipitation. Incorporation to a chemical depth of 2.5 to 5.0 cm should occur within 7 days of a spring or fall application and within 2 days of a summer application. Fall applications will control weeds the following spring and summer. CAUTION: residues high enough to harm many crops may persisit after repeated applications in perennial crops.
	napropamide DEVRINOL 50W (50 WP) plus simazine SIMAZINE (80 WP)	4.500 kg/ha 9.00 kg/ha 1.096 kg/ha 1.37 kg/ha	Apply before weeds emerge on established plantings only. Will provide additional control of broadleaved weeds. See remarks under napropamide and simazine.

	simazine PRINCEP NINE-T (90 WG) SIMAZINE (80 WP)	2.250 to 3.380 kg/ha 2.50 to 3.75 kg/ha 2.81 to 4.23 kg/ha	Apply before weeds emerge on established plantings only. Nursery stock can be injured by a residue in the soil if this herbicide is used where stock is removed and replaced with another planting. this herbicide cannot be used around ornamental shrubs if the area is to be under planted to ground cover or bedding plants. CAUTION: residues high enough to harm many crops may persist after repeated applications in perennial crops.
	trifluralin TREFLAN (545 g/L) RIVAL (500 g/L) TRIFLUREX 40 EC (400 g/L)	0.600 to 1.150 kg/ha 1.10 to 2.10 L/ha 1.20 to 2.30 L/ha 1.50 to 2.75 L/ha	Apply to weed free soil. Incorporate after application. This treatment does not control ragweed, annual nightshade or mustards, and lady's-thumb may also escape the treatment. Annual grass control is usually excellent. Use lower rate on light soils.
Quackgrass, thistles, bindweed	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply in the late fall as a granular application. Apply in cool weather. Check label for tolerant species.
Quackgrass	propyzamide KERB (50 WP)	1.500 kg/ha 3.00 kg/ha	Apply in the late fall when the soil temperature is low but above freezing. Soil moisture should be high. This herbicide is absorbed through the roots.
Postemergence			
Emerged annual weeds	glyphosate ROUNDUP (356 g/L)	0.801 to 1.245 kg/ha 2.25 to 3.50 L/ha	Apply to actively growing weeds. Do not allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).
	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Use a chemical mower. Can be used several times during the year. Direct spray to avoid the leaves or green bark of nursery plants. For spot treatment, use 25 mL product in 4 L water.
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	Use the higher rate (2.0 L produce/ha) when quackgrass is present. Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g. 'Bar Harbour', 'Blue Acres', and 'Blue Rug') can be injured by over-the-top applications. CAUTION; THERE ARE DIFFERENCES BETWEEN CULTIVARS IN SENSITIVITY TO FUSILADE, e.g. *Juniperus horizontalis* 'Blue Acres' is sensitive while *Juniperus horizontalis* 'Plumosa Compacta' is tolerant. Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.
Emerged perennial weeds	glyphosate ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	For the control of quackgrass, apply glyphosate at 1.69 to 2.49 kg/ha when the quackgrass has at least 3 to 4 new leaves on each shoot. Canada thistle should be in the early bud stage, field bindweed in full flower and milkweed at the bud stage of growth. Use 2.49 to 4.27 kg/ha in 200 to 400 L water per hectare as a directed spray in established nursery plantings (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).

CAUTION: Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labelled species/cultivars before use.

WOODY NURSERY STOCK: CONTAINER

Cultural Weed Control

A successful weed control program must integrate cultural and chemical weed control practices.

Prepare the container bed area with a gravel layer and/or ground covers such as black plastic or opaque woven material. It is important that these surface covers exclude light in order to be effective in preventing weed seed germination. These ground covers can be used for a number of years before being replaced.

Keep the container beds and roadways free of weeds by physical removal or chemical mowing. Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weed escapes before they set seed by cultural removal or chemical mowing. In some situations, such as along fences, tools such as a weed whip may be useful. Look for the source of weeds that disseminate into container areas such as poplars, willows, willowherb and Canada fleabane.

Control weeds around irrigation ponds so that small seeded weeds are not being sown into container stock with each watering. A vigorous grassed bank will help reduce weed infestations as well as providing band stabilization. A filtering system in the irrigation line will remove weed seeds.

Removal of existing weeds from container stock before they flower MUST BE A PRIORITY JOB. Once a weed flowers it can disseminate hundreds of seeds by wind or by catapulting seeds. Many container weed species have several generations per year because their seeds do not need to overwinter before germinating. Remove and discard all pulled weeds well away from the growing area so that seeds are not disseminated into nearby containers.

Since many species of container weeds overwinter in the protected environment of a polyhouse, it is important to thoroughly weed container stock in the fall. Be sure to remove the rosettes of winter annuals such as shepherd's-purse and Canada fleabane and established plants and seedlings of common and mouse-eared chickweed. If not removed, these plants will be flowering by May or earlier.

WOODY NURSERY STOCK: CONTAINER BED PREPARATION

WEEDS	**Generic Name** **TRADE NAME** **(Formulation)**	**Rate (Active)** **RATE** **PRODUCT**	**REMARKS (For more information, see "Notes on Chemicals" section.)**
Preemergence			
Germinating annual weeds	dichlobenil CASORON (4 Gr)	4.400 to 7.000 kg/ha 110.00 to 175.00 kg/ha	Apply to bare soil before putting container pots on beds. For the best results, apply to soil with more than 2% organic matter content. Use on gravel or sandy soils may result in inconsistent weed control. Apply in spring when temperatures are cool and incorporate immediately with irrigation or mechanical incorporation. Do not cover polyhouses with plastic within one month after application and do not apply within plastic covered polyhouses or within greenhouse structures. Refer to label for tolerant species. NOT REGISTERED FOR USE IN POTS OF CONTAINER STOCK. DO NOT TRANSPLANT INTO TREATED SOIL FOR ONE YEAR.
Postemergence			
Emerged annual weeds	glyphosate ROUNDUP (356 g/L)	0.800 to 1.250 kg/ha 2.25 to 3.51 L/ha	Apply to actively growing weeds. Do not allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).

	paraquat GRAMOXONE (200 g/L)	1.100 kg/ha 5.50 L/ha	Use as a chemical mower. Can be used several times during the year. Direct spray to avoid the leaves or green bark of nursery plants. For spot treatments use 25 mL product in 4 L water.
Emerged perennial weeds	glyphosate ROUNDUP (356 g/L)	1.690 to 4.270 kg/ha 4.75 to 12.00 L/ha	For the control of quackgrass, apply glyphosate at 1.69 to 2.49 kg/ha when the quackgrass has at least 3 to 4 new leaves on each shoot. Canada thistle should be in the early bud stage, field bindweed in full flower and milkweed at the bud stage of growth. Use 2.49 to 4.27 kg/ha in 200 to 400 L water per hectare as a directed spray. Do not allow spray contact with leaves or green bark of trees or shrubs (also see SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section).

WOODY NURSERY STOCK: CONTAINER STOCK, POST PLANTING

Do not apply herbicides within covered polyhouses, or within four weeks before covering. Certain types of container stock may be injured by the following herbicides. Check manufacturer's directions for labelled species/cultivars before use.

NOTE: To convert kg or L/ha to g or mL/100 m^2 multiply by 10 (example: 11 kg/ha becomes 110 g/110 m^2 and 28.4 L/ha becomes 284 mL/100 m^2).

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Preemergence			
Germinating annual weeds	napropamide DEVRINOL 50W (50 WP) DEVRINOL 10G (10 Gr)	4.500 kg/ha 9.00 kg/ha 45.00 kg/ha	Apply at any time of the year to a weed free soil surface. May be applied to newly planted container stock after the potting media has settled from first watering. Incorporate by watering within 7 days of a spring or fall application and within 2 days of a summer application. Will not control bittercress.
	simazine PRINCEP NINE-T (90 WG)	2.250 kg/ha 2.50 kg/ha	For use on juniper, cedar and yew. Apply once per season, one month after planting. Apply prior to weed emergence; if weeds have emerged, remove them from the containers before application.
Postemergence			
Emerged quackgrass and annual grasses	fluazifop-butyl FUSILADE (250 g/L) plus surfactant AGRAL 90	0.150 to 0.500 kg/ha 0.60 to 2.00 L/ha	See notes under FIELD-GROWN NURSERY STOCK section. Consult the label for list of tolerant species. BE AWARE THAT THERE ARE DIFFERENCES BETWEEN CULTIVARS IN SENSITIVITY TO FUSILADE. AGRAL 90 to be applied 1 litre in 1000 litres spray solution.

Table 11. Nursery Herbicide Weed Control Ratings

The chemical ratings in this chart give general comparisons based on use as described in this guide. Under unfavourable conditions (eg., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated.

Rating: E - Excellent F - Fair
G - Good P - Poor

			ANNUAL BROADLEAVES							ANNUAL GRASSES						PERENNIALS																	
Treatment	Trade Name	Method of Application	chickweed, common	groundsel	lamb's-quarters	mustards	pigweeds	ragweed	smartweeds and lady's-thumb	barnyard grass	bromegrass	crabgrass	fall panicum	foxtails	witchgrass	bindweeds	chickweed, mouse-eared	dandelion	grape, wild	ground-ivy (Creeping Charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	toadflax, yellow	vetches	virginia creeper
glyphosate	ROUNDUP	post (preplant)	E	F	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G	F		F	E	F	E	E	E	G	F	E	F	F[1]	G
trifluralin	TREFLAN or RIVAL or TRIFLUREX	ppi (pre or post planting)	G	P	G	P	G	P	F	E		E	E	E	E	P	G				P		P	P			P	P		P		P	
chlorpropham	CIPC	pre			F	P	G	P	E	E	G	E	G	E	G						P						P	P		P			
chloramben	GARDEN WEED PREVENTER	pre			E	P	E	G	E	G		G	F	G	G	P					P		P	P			P	P		P			
chlorthal	DACTHAL	pre	G	P	G	P	G	P	P	F		G	G	G	G						P			P			P	P		P		P	
dichlobenil	CASORON	pre	E	E	E	E	E	E	E	G	P	F	F		G	P	G	G	P	F	F			G	G		G	G		G		G	
napropamide	DEVRINOL	pre	G	G	E	P	E	G	F	E	E	E	E	E	E			P						F			P					P	
propyzamide	KERB	pre	G			G			G	E	E	E	E	E	E												G						
simazine	PRINCEP NINE-T or SIMAZINE	pre	E	E	E	E	E	E	E	E	E	G	F	E	E						P			P			P	P		P		P	
fluazifop-butyl	FUSILADE	post	P	P	P	P	P	P	P	E	E	E	E	G	E	P	P	P	P	P	P	P	P	P	P	P	G	P	P	P	P	P	P
glyphosate	ROUNDUP	post	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	F	G	F	F	F	E	F	E	E	E	G	F	E	F	F[1]	G
paraquat	GRAMOXONE	post	E	E	E	E	E	E	E	E	E	E	E	E	E	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]	P[1]

---

[1] *Repeated treatments may provide control.*

OTHER HORTICULTURAL USES

DRIVEWAYS, PATIOS AND PATHS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Many broadleaf weeds and grasses	ammonium sulphamate POISON IVY & BRUSH KILLER (500 g/L)	0.034 L water 0.068 L/L water	Ammonium sulfamate is not selective, that is, it will kill all plants on which it is sprayed. Spray enough to wet weed foliage. Wash all spray equipment immediately after use as this chemical is very corrosive.
	paraquat GRAMOXONE (200 g/L)	0.600 to 1.100 kg/ha 3.00 to 5.50 L/ha	Apply in 275 L water per hectare. This product is not available to the home gardener but can be used by nurserymen, landscape contractors and farmers. It should be applied as a directed spray to avoid wetting the leaves and green bark of shrubs, and other garden plants. For spot treatments use 30 mL of product in 10 L water per 100 m^2.
	paraquat C.I.L. WEED & GRASS KILLER WEED-BAN		These products are packaged in small quantities for the home garden trade. The granules are readily dissolved in water so that application can be made with a watering can or garden sprayer. It is used as a "chemical mower". Use low pressure and a coarse spray to prevent drift onto lawns, flowers, vegetables and green leaves of other desirable plants. (See note above). **Follow directions on label.**
	glyphosate C.I.L. CLEAR-IT 1, C.I.L. CLEAR-IT 2, C.I.L. CLEAR-IT 3		This product is packaged in small quantities for the home garden trade. Use low pressure and a coarse spray to prevent drift onto lawns, flowers, vegetables and green leaves of desirable plants. **Follow directions on label.**

ERADICATING PERSISTENT PERENNIALS OR SHRUBS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Shrubs or herbaceous perennials	ammonium sulphamate POISON IVY & BRUSH KILLER (500 g/L)	3.000 kg/ha 6.00 kg/ha	The treatment with ammonium sulfamate is useful in handling persistent weeds, perennials that have become too aggressive, or shrubs such as lilacs, in garden areas. The chemical at the above rates will render the soil barren for about one season. However, it will breakdown in time, and the soil fertility will not be impaired. Damage may occur to desirable trees or other plants with roots that enter the treated area, or to plants located in lower portions of the garden onto which the chemical has been washed. Due precautions should be taken.

SEEDBEDS AND POTTING SOIL

NOTE: To convert kg or L/ha to g or mL/100 m^2 multiply by 10 (example 11 kg/ha becomes 110 g/100 m^2 and 28.4 L/ha becomes 248 ml/100 m^2).

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Seeds of most weeds	dazomet BASAMID (98 Gr)	490.200 kg/ha 500.00 kg/ha	See "Notes on Chemicals" section. Refer to manufacturer's directions for specific details as well as direction on sealing soil, evacuating gases and performing the safety germination test. Do not use below 6C.
	methyl bromide/ chloropicrin TERR-O-GAS 67 (67 Li)		A poisonous gas which must be applied under a gas proof cover (usually plastic). Its use is subject to the Pesticides Act. It may be used by the grower on his own seedbeds but he must obtain a permit from the Ontario Ministry of the Environment each time it is used. The manufacturer's instructions must be followed, and the seedbed or greenhouse aired thoroughly after the treatment period. If there is any question, the safety precautions in the Pesticides Act should be studied, or inquiry made at the local office of the Ontario Ministry of Agriculture and Food or the Ontario Ministry of the Environment. **Follow manufacturer's directions.**
	metam sodium VAPAM (380 g/L)	480.770 kgha 1250.00 L/ha	Apply as a drench to a soil that should be wet to a depth of at least 8 cm. Do not plant for 10 to 14 days or longer if the weather is cool.
	methyl isothyiocyanate/ dichloropropene VORLEX PLUS (203 g + 373 g/L)	32.183 to 258.620 kg/ha 56.00 to 450.00 L/ha	A liquid soil fumigant which is injected into the prepared seedbed by means of special applicators.
	methyl isothyiocyanate/ dichloropropene/ chloropicrin VORLEX PLUS CP (185 g + 370 g + 163)	40.207 to 323.741 kg/ha 56.00 to 450.00 kg/ha	Chloropicrin provides additional disease control to the mixture.

SPECIAL METHODS OF WEED CONTROL - Site Preparation

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Site Preparation			
Emerged annual broadleaf weeds	glyphosate* ROUNDUP (356 g/L)	0.801 to 1.245 kg/ha 2.25 to 3.50 L/ha	Glyphosate can be applied to actively growing weeds in the fall, or spring prior to planting any crop. Application to annual weeds will only control those emerged. Annual weed control programs will be necessary to control weeds germinating after planting.

Quackgrass	glyphosate* ROUNDUP (356 g/L)	1.690 to 2.491 kg/ha 4.75 to 7.00 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50 to 100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" section and product labels for registered rates of glyphosate, surfactants and appropriate water volumes. For quackgrass control, apply to actively growing quackgrass when at least 3 to 4 new leaves are present. The low rate (2.49 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control The higher rates of ROUNDUP may be applied in 100 to 300 L/ha water.
Other perennials	glyphosate* ROUNDUP (356 g/L)	2.491 to 4.270 kg/ha 7.00 to 12.00 L/ha	Canada thistle should be at least in early bud, milkweed at bud and bindweed at full flower for best results. Delay cultivation 5 days or more after application.
Stale Seedbed and Inter-Row Weeding			
Emerged seedling and annual weeds	paraquat GRAMOXONE (200 g/L) or diquat REGLONE (200 g/L)	0.600 to 1.100 kg/ha 3.00 to 5.50 L/ha 0.600 to 1.100 kg/ha 3.00 to 5.50 L/ha	One of these herbicides may be used to kill emerged weeds on a prepared seedbed before the crop seed is sown. Check label for list of crops for which this technique is registered. In inter-row weeding, special low pressure equipment is used to apply the herbicide on emerged weeds without contact with leaves of the crop plants. For small areas, apply 30 mL product in 100 L water per 100 m².
	paraquat/ diquat C.I.L. WEED & GRASS KILLER WEED-BAN	See label	DOMESTIC - Soluble granular formulations for home garden use. Check label for rates.
Spot Treatments with Hand-Held Equipment for Selective Weed Control			
Canada thistle, sow-thistle, hoary cress, milkweed, poison ivy and toadflax	amitrole AMITROL-T (200 g/L)	7.500 kg/ha 37.50 L/ha	Thoroughly wet all leaves and stems of weeds. Refer to label for appropriate stage of weed growth. Repeat applications when new growth appears. Registered for non crop land and pasture. Do not graze treated areas until six months following treatment.
Horsetail, leafy spurge and quackgrass	amitrole AMITROL-T (200 g/L)	15.000 kg/ha 75.00 L/ha	
Emerged annual and perennial weeds	glyphosate* ROUNDUP (356 g/L)	1.000 % solution 2.81 % solution	See label for appropriate stage of weed development and for a list of crops for which this technique is registered.
Harder to control perennials such as field bindweed, hemp, dogbane, milkweed and Canada thistle	glyphosate* ROUNDUP (356 g/L)	2.000 % solution 5.62 % solution	See label for appropriate stage of weed development and for a list of crops for which this technique is registered.
Annual weeds	glyphosate EXPEDITE GRASS & WEED (147 g/L)	0.882 to 1.250 kg/ha 6.00 to 8.50 L/ha	Expedite herbicides are ready-to-use products which must be applied with the Expedite application system. This low volume application should not be applied "spray to wet" or runoff. Material should be calibrated for proper use rate prior to application. Consult label for calibration and application instructions.

Emerged quackgrass and Canada thistle	glyphosate EXPEDITE GRASS & WEED (147 g/L)	1.250 to 2.500 kg/ha 8.50 to 17.00 L/ha	See above comment.
Emerged harder to control perennial weeds such as field bindweed and milkweed	glyphosate EXPEDITE GRASS & WEED (147 g/L)	2.500 to 4.265 kg/ha 17.00 to 29.00 L/ha	See above comments.

* *Additional products are available. See Table 1.*

BRUSH CONTROL

There are several techniques that may be used for the chemical control of deciduous woody species: stem foliage sprays, basal bark sprays and frilling or spot treatments. The choice of technique will depend on such factors as brush type, accessibility, availability of equipment, proximity to susceptible crops or ornamental vegetation and the size of the control program.

Stem Foliage Treatments Applied to "Runoff"

NOTE: Stem foliage treatment of brush should be limited to smaller growth (less than 2 m in height). Treatments should be applied to thoroughly wet the stems and foliage to the point of runoff. This technique is most effective just after full leaf development in late spring or early summer. The choice of chemicals for controlling stands of deciduous brush should be based on the susceptibilities of the predominant species (Table 10) or whether the brush to be controlled is near homes, recreational areas, etc.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Most deciduous woody species	2,4-D*	3.000 to 6.000 kg/1000 L	One application may be sufficient for sensitive species. For intermediately sensitive species, repeated treatments are normally required.
	dichlorprop/ 2,4-D***	5.000 to 6.000 kg/1000 L	Apply at the LOW-VOLATILE ESTER in areas dominated by species expected to be tolerant to 2,4-D alone.
	triclopyr GARLON 4 (480 g/L)	1.922 to 3.845 kg/1000 L 4.00 to 8.00 kg/1000 L	Apply to the point of run-off when the brush is actively growing. Use the higher rate for the more difficult species (See Table 1, follow manufacturer's directions.
	dicamba/ 2,4-D (1:2) DYCLEER 24 (600 g/L) or dicamba DYCLEER (480 g/L) plus 2,4-D 2,4-D (500 g/L)	6.000 kg/1000 L 10.00 to 1000.00 L 2.020 kg 4.20 L 4.00 kg/1000 L 8.00 L/1000 L	Apply to the point of runoff when the leaves are fully expanded.
Most deciduous woody species (excluding white ash)	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	3.050 kg/1000 L 10.00 L/1000 L	Apply to wet the stems and foliage to the point of runoff when the leaves are fully expanded. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).
White ash, sugar maple	dicamba DYCLEER (480 g/L) plus dichlorprop/ 2,4-D DIPHENOPROP ((1:1) 700 g/L)	2.500 kg/1000 L 5.20 L/1000 L 5.070 kg/1000 L 7.25 L/1000 L	Follow instructions on DYCLEER label and prepare as a tank mix. Apply to the point of runoff when leaves are fully expanded.
Oak, maple, alder, hickory and ash	fosamine ammonium KRENITE (480 g/L)	4.810 to 7.210 kg/1000 L 10.00 to 15.00 L/1000 L	Additional surfactants may be required for difficult species. Follow manufacturer's directions

Non selective control, most woody and herbaceous species	glyphosate* ROUNDUP (356 g/L)	3.500 to 5.000 kg/1000 L 9.84 to 14.05 L/1000 L	Can be applied during June, July or August.
	ammonium sulphamate POISON IVY & BRUSH KILLER g/5 L (500 g/L)	200.000 to 250.000 g/5 L 400.00 to 500.00	Thoroughly wet all foliage.

* *Additional formulations are available. See Table 1*

Constant Volume Foliar Applications

NOTE: For Brush Control on Roadsides and other Rights-of-Way

Most deciduous woody species (excluding white ash)	dichlorprop/ 2,4-D*	5.000 to 6.000 kg/ha	Apply in 300 to 400 L of water per hectare during periods of active growth.
	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	5.488 to 7.621 kg/ha 18.00 to 25.00 L/ha	Apply in 450 L water per hectare during the active growing season. Use an approved drift control system or additive. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).
	dicamba DYCLEER (480 g/L) plus 2,4-D 2,4-D (500 g/L)	2.000 kg 4.16 L 4.000 kg/ha 8.00 L/ha	Apply in sufficient water (220 to 330 L/ha) to wet all foliage. Amine or ester foliage formulations of 2,4-D may be used.
	dicamba DYCLEER (480 g/L) plus dichlorprop/ 2,4-D 2,4-D/dichlorprop (700 g/L)	2.500 kg 5.20 L 5.000 kg/ha 7.20 L/ha	Apply in sufficient water (200 to 330 L/ha) to wet all foliage.

Basal-Bark Treatments in Oil as a Carrier

NOTE: The BASAL-BARK treatment is useful on a wide range of trees and brush with a trunk diameter up to about 15 cm. The chemical is applied so as to thoroughly cover the basal 30 cm of the trunk and any exposed roots. For oak, hickory, basswood or ash, treatments are most effective from February to June. Most other species may be treated at any season of the year. Light, simple equipment, coupled with the possibility of winter operations when labor is cheaper and access to swampy areas possible, give this treatment an important role in a brush control program.

Most woody species, including conifers	dichlorprop/ 2,4-D Spray bark to wet only	2.000 kg/100 L	Use the LOW-VOLATILE ESTER formulations in fuel oil.
Hawthorn	2,4-D	3.000 kg/100 L	Use the LOW-VOLATILE ESTER formulations in fuel oil.

Stump Treatment After Cutting

NOTE: In many cases it is more desirable to remove existing brush by hand than to kill it by spraying and leaving the dead material standing. The stump treatment is particularly useful in preventing the vigorous regrowth that is the characteristic response of many deciduous species after the cutting. Moreover, killing the stump is the first step towards encouraging it to rot.All of the treatments must be applied to freshly exposed wood. They may be applied at any season of the year, preferably

right after the tree or brush is cut. If, however, an old stump is to be killed, split with a wedge, or have holes drilled into it, so that fresh wood is exposed to the chemical. Regrowth from an old stump is treated as well as the stump proper. Most species can be controlled with 2,4-D as the LOW VOLATILE ESTER at a concentration of 2 kg (acid) per 100 L fuel oil or by 2,4-D/dichlorprop mixtures 1:1 at concentrations of 2.7 to 2.75 L of product per 100 L oil. These treatments can be applied as a spray or paint. WEEDONE CB (2,4-D/dichlorprop 1;1) will control stumps of any height and up to 10 cm in diameter, as long as the remaining wood, bark, and roots are thoroughly treated. Stumps do not require immediate treatment, permitting separate cut and spray operations.Most species can be controlled in any season with an application of TORDON 101 MIXTURE (picloram/2,4-D,1:3.7) at a concentration of 1:1 with water or ethylene glycol (to depress the freezing point during winter applications). The solutions should be painted or sprayed onto the exposed, freshly cut stump to provide thorough coverage of the cambium layer. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).If spray is used, all surfaces of the stump should be treated. Various dye materials may be added to the herbicide to facilitate keeping track of sprayed stumps. (See applications indicators).

EVERGREEN OR CONIFER CONTROL

Stem Foliage Treatments with Water as a Carrier

All of the treatments are applied so as to thoroughly wet all foliage. Use low pressure and apply from 500 to 1500 L solution per hectare, depending on the amount of foliage. The TCA treatments of evergreens, applied during the growing season, will control balsam, spruce, and pine. Thorough coverage is particularly important and the addition of a wetting agent will increase effectiveness.

WEEDS	**Generic Name TRADE NAME (Formulation)**	**Rate (Active) RATE PRODUCT**	**REMARKS (For more information, see "Notes on Chemicals" section.)**
Spruce, balsam, pine	TCA	11.765 to 16.471 kg/1000 L	Follow manufacturer's directions on the label. This treatment can be combined with 2,4-D, dichlorprop treatments that are recommended for the species of deciduous brush present (Table 10).
	NATA GRASS KILLER PELLETS kg/1000 L (85 SG)	13.88 to 19.44	
	ammonium sulphamate POISON-IVY AND BRUSH KILLER (500 g/L)	3.000 kg/100 L 6.00 kg/100 L	Follow manufacturer's directions on the label. This treatment can be combined with 2,4-D, dichlorprop treatments that are recommended for the species of deciduous brush present (Table 10).
	paraquat GRAMOXONE (200 g/L)	1.000 kg/1000 L 5.00 L/1000 L	Apply in spring or early summer. Thorough coverage is needed. This treatment can be combined with 2,4-D, dichlorprop treatments that are recommened for the species of deciduous brush present (Table 10).
All conifers including black and white spruce	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	2.600 to 3.050 kg 8.50 to 10.00 kg	Use the higher rate of TCA after the terminal buds and the conifers have hardened off and the current year's foliage has darkened. A PERMIT FOR PURCHASE AND USE OF PICLORAM IS REQUIRED. (See "Notes on Chemicals" section).
	plus TCA	10.600 to 14.800 kg/1000 L	
	NATA GRASS KILLER PELLETS kg/1000 L (85 SG)	12.51 to 17.46	

Mixed stands (conifers and deciduous brush)	dicamba/ 2,4-D (1:2) DYCLEER 24 (600 g/L) dicamba DYCLEER (480 g/L) plus 2,4-D 2,4-D (500 g/L)	2.000 to 4.000 kg/1000 L 10.00 L/1000 L 2.000 kg/1000 L 4.20 L 4.000 L/1000 L 8.00 L/1000 L	Apply as AMINES in early summer. Thorough coverage is needed.
	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE (305 g/L)	3.500 kg/1000 L 10.00 L/1000 L	Apply when the conifers are actively growing in early summer. Spray should thoroughly wet all plant parts including stem, foliage, and root collar. A PERMIT IS REQUIRED FOR PURCHASE AND USE. (See "Notes on Chemicals" section).
Mixed stands (conifers and deciduous brush) on roadsides, etc.	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	5.490 to 7.620 kg/ha 18.01 to 24.99 L/ha	Apply in 450 L water per hectare as a constant volume foliar application during the period of active conifer growth in early summer. Use an approved drift control system or additive. A PERMIT FOR PURCHASE AND USE IS REQUIRED. (See "Notes on Chemicals" section).
	dicamba DYCLEER (480 g/L) dichlorprop/ 2,4-D DESORMONE ((1:1) 680 g/L)	2.500 kg/1000 L 5.20 L/1000 L 5.000 kg/1000 L 7.35 L/1000 L	Apply in spring or early summer. Thorough coverage is needed. Follow instructions on Dycleer label for tank mix.

GENERAL TREATMENTS FOR WOODY SPECIES

Soil Treatment

Single or scattered trees or shrubs may be controlled efficiently with dry applications of sodium borate, chlorate mixtures or ammonium sulfamate (WILSON'S POISON-IVY AND BRUSH-KILLER). Apply the chemical in a band at the base of the plant, following the manufacturer's directions.

Basal (Spot) Treatment

On stands of deciduous or coniferous brush that range from light to scattered, use individual spot treatment with bromacil (HYVAR X-L). It may be applied with an exact delivery hand gun. Apply undiluted at 10 g per metre of height (5 cm diameter) or brush or dilute 1 L HYVAR X-L with 5 L of water and apply 60 G per metre of height of brush. Taller and larger brush requires progressively more herbicide.

Tebuthiuron (SPIKE 80 WP) may also be used as a spot treatment to control standing or cut brush in non crop land or non landscaped areas. Apply 2 g active tebuthiuron to stumps or trunks less than 5 cm in diameter. For larger stumps or trunks, apply an additional 2 g tebuthiuron on opposite side of stem. With a mixture of 125 g produce (SPIKE 80 WP) per litre, a properly calibrated spot gun or back pack sprayer can be employed to deliver 20 mL or 40 mL per tree, respectively, to apply the proper rates of active ingredient described above. See manufacturer's label for applications, instructions and precautions.

Sucker Growth Control After Pruning

Many trees sprout prolifically after they have been pruned. The application of fortified tree wound dressings to the surface of the cuts can reduce the number of new sprouts from many tree species.

These paints improve natural inhibition achieved through the use of poor trimming practice. All pruning should be done to strong laterals. Severe pruning should be avoided.

Best results will be obtained if the materials are applied to the cuts between April 15 to July 15. Treatment of all cuts is important, as each is a potential location for sprouting from both dormant and adventitious buds. Cover the entire cut and about 2 cm of the surrounding bark, especially below the cut. Heavy tree wound dressing will adversely affect the rate of callus formulation of some species.

Alpha naphthalene acetic acid, ethyl ester (THREHOLD), as a 1% surface tree wound dressing or aerosol can be effective on willow, poplar, maple, oak, elm, basswood, apple and possibly other species.

Tree Injection

Glyphosate as a 0.15 g EZJECT capsule can be used to control woody brush and trees with an EZJECT capsule injection system. Capsules must penetrate through the outer bark and into the inner living tissue to provide effective results. Capsules should be spaced evenly around the tree, below all major branches at a rate of 1 capsule per 20 cm stem diameter at breast height (dbh). Stems should be in excess of 3 cm dbh but usually not in excess of 20 cm dbh. Trees should not be frozen at time of treatment. Allow 1 to 2 years for complete control.

PERENNIAL WEED CONTROL (NON CROP LAND)

Perennial weeds are more difficult to control than annual weeds because regrowth occurs rapidly from underground parts after the top growth is removed by chemical or mechanical means. In non crop land they pose a special problem because cultivation cannot be used for their control. Chemicals must kill the root system as well as the above ground parts to give effective perennial weed control.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
All perennnials, non selective	diuron KARMEX (80 DF)	11.200 to 44.000 kg/ha 14.00 to 55.00 kg/ha	Apply in 1000 L water per hectare.
	bromacil HYVAR X-L (240 g/L) HYVAR X (80 WP)	7.195 to 10.792 kg/ha 30.00 to 45.00 L/ha 9.00 to 13.75 kg/ha	
	bromacil/ diuron (1:1) KROVAR (80 WP)	11.000 to 15.000 kg/ha 13.75 to 18.75 kg/ha	
Many perennial broadleaved weeds including Canada thistle, dandelion, field horsetail	chlorsulfuron GLEAN (75 DF)	90.225 g/ha 120.00 g/ha	A surfactant should be added to improve control. Follow manufacturer's directions.
Many perennial weeds including Canada thistle, wild carrot and goldenrod	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	2.134 kg/ha 7.00 L/ha	Apply in 200 L water per hectare during spring or early summer after growth appears. Use an approved drift control additive or system. A PERMIT IS REQUIRED FOR PURCHASE AND USE (see "Notes on Chemicals" section).
Many perennial weeds including yellow nutsedge	dichlobenil CASORON (4 Gr)	11.000 to 22.000 kg/ha 275.00 to 550.00 kg/ha	To use as a split application, apply 150 kg product in the fall and follow with 150 kg product in early spring.
2,4-D susceptible weeds	2,4-D* 2,4-D (500 g/L)	1.100 to 1.800 kg/ha 2.20 to 3.60 L/ha	See Table 13 for list of weed susceptibilities to 2,4-D and related chemicals.
Canada thistle or perennial sow thistle	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L) dicamba BANVEL 480 (480 g/L)	3.200 kg/ha 5.50 L/ha 1.108 kg/ha 2.30 L/ha	Apply spray in late spring just prior to flowering, or apply to regrowth escaping other treatments, in summer or fall.

	amitrole AMITROL-T (200 g/L)	4.500 to 6.760 kg/ha 22.50 to 33.80 L/ha	Apply when most thistles reach the bud to bloom stage. Treated plants should not be mowed or tilled for at least 3 weeks after treatment.
Field bindweed, milkweed, Canada thistle and common tansy	glyphosate ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply 200 to 300 L water per hectare when field bindweed has reached full flower, and Canada thistle and milkweed have reached the bud to bloom stage.
Most biennial and perennial broadleaved weeds	dichlorprop/ 2,4-D* SILVAPROP (700 g/L)	2.250 to 3.250 kg/ha 3.22 to 4.65 L/ha	Apply as the LOW-VOLATILE ESTER in 200 to 300 L water per hectare during summer for most species.
Field bindweed, leafy spurge and cypress spurge	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L)	3.200 kg/ha 5.50 L/ha	Apply sprays in mid June or during flowering, in 100 to 200 L water per hectare.
	dicamba BANVEL 480 (480 g/L)	1.108 kg/ha 2.30 L/ha	
Milkweed	amitrole AMITROL-T (200 g/L)	4.500 to 6.750 kg/ha 22.50 to 33.75 L/ha	Apply 500 to 1000 L water per hectare after most shoots have emerged but before flowering.
Goldenrod	2,4-D*	1.000 to 2.000 kg/ha	Apply in 1000 L water per hectare.
	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L)	3.195 L/ha 5.50 L/ha	Apply when weed is actively growing, in 100 to 200 L water/ha.
	dicamba BANVEL 480 (480 g/L)	1.108 kg/ha 2.30 L/ha	
Quackgrass and other creeping perennial grasses	amitrole AMITROL-T (200 g/L)	4.400 to 7.000 kg/ha 22.00 to 35.00 L/ha	Apply to actively growing quackgrass foliage when growth is 15 to 20 cm in height. Wait at least 10 days before plowing or disking. With amitrole, most field crops can be planted safely 2 to 3 weeks after applying the chemical.
	glyphosate* ROUNDUP (356 g/L)	0.840 to 0.890 kg/ha 2.36 to 2.50 L/ha	For a minimum of one season control of quackgrass, apply in the fall or spring before planting. Apply, using flat-fan nozzles, in 50 to 100 L per hectare of water. For use in higher water volumes, the addition of a surfactant such as Enhance or Frigate is recommended. Refer to "Notes on Chemicals" and product labels for registered rates of glyphosate, surfactants and appropriate water volumes.
	propyzamide KERB (50 WP)	1.100 to 1.800 kg/ha 2.20 to 3.60 kg/ha	Apply in fall from late September to early November but before soil freezes. Control of weeds other than perennial grasses cannot be expected.
Canada thistle, dandelion, or field horsetail	chlorsulfuron GLEAN (75 DF)	90.225 g/ha 120.00 g/ha	A surfactant should be added to improve control. Follow manufacturer's directions. Grasses may also be injured.

* *Additional formulations available. See Table 1.*

CAUTION: **Unless otherwise recommended, the above treatments should not be used in crop situations. Their use should also be avoided if the chemical is likely to wash or leach into areas occupied by the roots of desirable trees or other plants. Precautions should also be followed to avoid spray drift onto non target vegetation.**

The use of atrazine, simazine, bromacil, or diuron non selectively, as described above, is generally limited by cost to the handling of small patches of perennial weeds. The chemical either leaches down to the weed root system or makes the surface soil toxic for a period of time varying from a few months to several years, depending on the chemical, rate of application and soil type. Generally, crops cannot be grown successfully until the effect of the chemical has disappeared. Corn, however, can be grown safely when high rates of simazine and atrazine are applied.

Some perennial weeds, such as field bindweed, horsetail, goldenrod, milkweed and bracken fern, are difficult to eradicate at the lower rates of diuron, simazine, atrazine and bromacil. Follow the manufacturer's directions carefully if the area is to be re-seeded. The amitrole treatment is of value in spot treating patches of quackgrass in a field that is not entirely infested.

While the tops of many perennial weeds may be controlled by doses of 2,4-D that may be selectively used in resistant crops, heavier doses, as described above, must be used if eradication is to be attempted. Several applications upon successive stages of regrowth will probably be necessary. Generally, treatments with 2,4-D during rapid development of the weed at about the early bud to flowering stages of growth are most effective. Spray should be applied to thoroughly wet all foliage.

Heavier doses of 2,4-D on patches of weeds may be applied during normal selective spraying operations merely by slowing down the sprayer speed in the infested areas. Local crop damage should be expected where this is done.

POISON-IVY CONTROL

Several chemicals have been shown to be effective for the control of poison-ivy. However, some growth may occur after treatment with any of these chemicals and retreatments will be necessary to achieve eradication. The chemical treatment of poison-ivy must take into account the location in which the weed is growing. If desirable shrubs or trees are present, soil sterilants should be avoided, and the other materials used with caution.

A 9-14 L sprayer is the most convenient method of applying herbicides to patches of poison-ivy. Thorough coverage of the leaves with the spray is essential for maximum effect. After spraying, the area should be left alone until the plants die, at which time the dead stems should be gathered up and buried. Even at this stage care should be taken as poisoning may be brought about by handling the dead plant. All treatments are most effective when the poison-ivy is in full leaf and growing actively, from about June 15 to July 31.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Poison-ivy	amitrole AMITROL-T (200 g/L)	2.000 kg/ha 10.00 L/ha	Apply in at least 1000 L water per hectare when plants are actively growing. Thoroughly wet all foliage.
	ammonium sulphamate POISON IVY & BRUSH KILLER 5 L (500 g/L)	200.000 to 250.000 in 5 L water 400.00 to 500.00 in water	Thoroughly wet all foliage.
	dichlorprop/ 2,4-D* SILVAPROP (700 g/L)	2.250 kg/ha 3.22 L/ha	Apply in sufficient volume of water to thoroughly wet all foliage.
	* Error: 0122 *	2.000 to 3.000 kg/10 m^2	Follow manufacturer's directions on the label.
	dicamba/ 2,4-D (1:2)*** DYCLEER 24 ((1:2) 582 g/L)	2.470 kg/ha 4.25 L/ha	Apply in at least 560 L water per hectare.

	glyphosate ROUNDUP (356 g/L) or	2.500 to 4.250 kg/ha 7.03 to 11.94 L/ha 50.00 mL/5 L water	Apply to actively growing plants in 200 to 300 L water per hectare to thoroughly wet the foliage but do not spray to the point of runoff.

* *Additional formulations available. See Table 1.*

** *Tank mixes of various individual 2,4-D and dicamba products are also available.*

REDUCTION OF HERBICIDAL DRIFT

In the application of herbicides, especially of the hormone type (2,4-D, mecoprop, dichlorprop, dicamba, etc.) sensitive crops (grapes, tomatoes, turnips, tobacco, beans, carrots, beets, fruit trees, ornamental plants and many others) beyond the area being sprayed can be damaged by vapor or spray drift. To reduce the danger of herbicidal drift:

1. Use only amine formulations when it is necessary to apply phenoxy herbicides (2,4-D, mecoprop, dichlorprop, etc.) near sensitive non target plants.

2. Very slight spray drift with herbicides containing dicamba can be more damaging to soybeans and other crops than equivalent amounts of 2,4-D spray drift. There is also a possibility of dicamba vapor drift from treated plant foliage during high temperatures (in excess of 25C); thus, use of dicamba containing herbicides should be avoided near sensitive, desirable plants.

3. Use the lowest pressure possible to apply the herbicide. This may mean the use of a dribble bar, Radiarc boom, vibrajet nozzle, Directa-spra nozzle, flood jet or more conventional nozzle tips.

4. Manufacturer's recommendations regarding nozzle spacing and height should be carefully followed. It may be necessary to mount nozzles on skids to keep them at a constant distance from the surface to be sprayed.

5. For roadside spraying various spray additives (i.e. BIVERT PH, LO-DRIFT, or Nalco-Trol) are available which may reduce spray drift by increasing the viscosity or density of the spray. These materials should be used following manufacturer's directions and observing normal precautions (vehicle speed, wind velocity, proximity to sensitive crops, etc.).

WARNING: These methods and materials can reduce but not eliminate herbicidal drift. In areas near sensitive crops, all normal precautions must be taken. It should be emphasized that extremely low, even invisible, amounts of spray drift can be very damaging to sensitive crops. In some cases, spraying during the growing season should not be considered.

ROADSIDES AND NON-CROP AREAS

Fencerows and Farm Areas

In agricultural areas, weeds growing in fencerows, around buildings and on roadsides are sources of potential weed infestation to other parts of a farm. In addition, brush and weeds around fields harbor insects, diseases and other pests that may be detrimental to farming operations. Shrubs like wild cherry may be possible sources of livestock poisoning. Farmers may also wish to reclaim land on which willows or brush have encroached.

It is also important to keep drainage ditches and farm ponds free of troublesome aquatic vegetation.

Roadsides, Rights-of-way and Waste Places

Road maintenance personnel are interested in controlling weeds and brush to reduce the cost of winter snow removal programs. Low vegetation will also give the road user clear view of other vehicles, animals, children and other hazards. It is important to prevent brush encroachment onto the roadway proper, to keep the drainage ditches open to prevent flooding and to minimize the fire hazard of tall, dry vegetation in the late summer. A grass cover also prevents soil erosion much better than weeds.

In some situations (i.e., hard to mow areas) chemical growth retardants can be used to reduce grass growth.

Both railway and power supply authorities are concerned with maintaining safe and accessible rights-of-way by controlling growth of weeds and brush.

In certain areas (beneath guide rails, in storage yards, under railway tracks and under fences at road intersections), it may be advantageous to completely kill all vegetation for a longer period of time. Chemicals and suggestions for their use in this way are presented in the section on LONG TERM TOTAL VEGETATION CONTROL.

In roadside and right-of-way spraying, for weed control or brush control, precautions should always be taken to minimize herbicide drift. It is advisable to inspect or monitor each roadside just prior to spraying to locate susceptible crops, water crossings and other sensitive areas. Appropriate "shut off" and "turn on" points should be marked so these areas can be avoided during the actual spray operation.

ROADSIDE GRASS RETARDATION (see TURF GRASS RETARDATION section)

ROADSIDE WEED CONTROL

The main objectives of a weed control program for roadsides are: (1) to control tall growing weeds so that mowing costs can be minimized; (2) to control weeds that may infest adjacent land by wind dispersal of seed; (3) to maintain an attractive grass cover that will minimize erosion problems; (4) to prevent buildup of excessive vegetation that can become a fire hazard in the late summer or complicate snow removal in winter; and most importantly, (5) to ensure highway safety. Most broadleaf weeds are susceptible to early summer applications of 2,4-D and related herbicides (Table 12). However, many weeds are not effectively controlled by 2,4-D mixtures and these resistant weeds can become an increasing problem unless other herbicides are used. The use of spot treatments with non selective chemicals that may temporarily injure the grass may be justified in some cases to control isolated, but dense, patches of difficult weeds before they spread and become a problem over a large area.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Annual broadleaf weeds in newly constructed areas and biennial or perennial broadleaves susceptible to 2,4-D	2,4-D*	1.100 kg/ha	Apply as the AMINE or LOW-VOLATILE ESTER in 200 to 300 L water per hectare in early summer. See Table 13 for weed susceptibilities for 2,4-D mixtures.
Most biennial and herbaceous perennial weeds	dichlorprop/ 2,4-D*	2.250 to 3.250 kg/ha	Apply as the LOW-VOLATILE ESTER in 200 to 500 L water per hectare during early summer for most species.
	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L)	1.600 to 3.320 kg/ha 2.75 to 5.50 L/ha	Apply as the AMINE in 100 to 200 L water per hectare when weeds are actively growing.
	chlorsulfuron GLEAN (75 DF)	53.000 g/ha 70.49 g/ha	A surfactant should be added to improve control. Follow manufacturer's directions.
	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	2.140 kg/ha 7.02 L/ha	Apply in 200 L water per hectare during the spring or early summer after growth appears. Use an approved drift control additive or system. A PERMIT FOR PURCHASE AND USE IS REQUIRED (see "Notes on Chemicals" section).
	triclopyr GARLON 4 (480 g/L)	0.480 to 1.924 kg/ha 1.00 to 4.00 L/ha	Apply in 200 to 300 L water per hectare when weeds are actively growing.
Spot treatments for difficult weeds: Canada thistle, perennial sow-thistle	dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L) dicamba DYCLEER (480 g/L)	3.200 kg/ha 5.50 L/ha 1.360 kg/ha 2.83 L/ha	Apply sprays in late spring just prior to flowering or apply to regrowth escaping other treatments in summer or fall.

	chlorsulfuron GLEAN (75 DF)	53.000 g/ha 70.49 g/ha	Asurfactant should be added to improve control. Follow manufacturer's directions.
	amitrole AMITROL-T (200 g/L)	4.500 to 6.760 kg/ha 22.50 to 33.80 L/ha	Apply to the point of runoff when the thistles are in the head stage of growth. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season.
	glyphosate ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply in 200 to 300 L water per hectare when the thistles are in the bud to full flower stage. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season. Also see, SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section.
	picloram/ 2,4-D (1:3.7) TORDON 101 MIXTURE ((1:3.7) 305 g/L)	2.135 kg/ha 7.00 L/ha	Apply in 200 L to 300 L water per hectare during spring or early summer when growth appears. Use an approved drift control additive or system. A PERMIT FOR PURCHASE AND USE IS REQUIRED (see notes section).
Leafy and cypress spurge	dicamba DYCLEER (480 g/L)	0.600 kg/ha 1.25 L/ha	Apply when weed is actively growing in 100 to 200 L water er hectare.
Leafy spurge	amitrole AMITROL-T (200 g/L)	9.000 to 11.000 kg/ha 45.00 to 55.00 L/ha	Spray between advanced flowering and seeding stage. Treated areas should not be mowed but may be worked up after top growth is bleached.
Field bindweed	dicamba DYCLEER (480 g/L) dicamba/ 2,4-D (1:2) DYCLEER 24 ((1:2) 582 g/L)	1.100 kg/ha 2.29 L/ha 3.195 kg/ha 5.50 L/ha	Apply in mid June or when flowering.
	2,4-D	1.100 kg/ha	Apply in mid June when flowering and repeat in early September.
	glyphosate ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply in 200 to 300 L water per hectare when the field bindweed has reached full flower. use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season.
Milkweed	amitrole AMITROL-T (200 g/L)	4.500 to 6.750 kg/ha 22.50 to 33.75 L/ha	Spray to wet in early summer before flowering. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season.
	glyphosate ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply in 200 to 300 L water/ha to thoroughly wet all foliage when milkweed has at least reached the bud stage. Use spot treatments only, since grasses are susceptible to this chemical and may be controlled for up to one season. Also see, SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section.
Horsetail, toadflax, quackgrass	amitrole AMITROL-T (200 g/L)	4.500 to 6.750 kg/ha 22.50 to 33.75 L/ha	Spray when horsetail is growing vigorously.
Goldenrod	dicamba DYCLEER (480 g/L)	1.100 kg/ha 2.29 L/ha	Apply when weed is actively growing in 100 to 200 L water per hectare.

* *Additional formulations are available. See Table 1.*

Bare Areas

It may be desirable to maintain certain areas completely free of vegetation. Usually two problems are involved. First, the existing vegetation must be destroyed, including the destruction of underground stems and roots of perennials. Second, the bare area thus produced must be maintained either by persistent soil active chemicals or by foliage treatment of weed seedlings.

Some chemcials will kill existing vegetation. Others, while excellent for maintaining the bare area, may be used more economically if combined with another chemical to kill existing growth. If a mixed population of weeds is present, combinations of chemicals that will kill the different weed types may be used advantageously.

Uniform coverage with all chemicals is essential. Touch up operations should be expected, as a single treatment will seldom give complete eradication.

It is usually found that two appplications of the lower recommended rate (i.e., 5.5 to 11 kg per hectare), depending on the chemical used, spaced 6 to 12 months apart, give better results than one single application of the higher recommended rate. This approach also reduces the risk of off-site movement.

The length of weed control obtained will depend on several factors which include rainfall, soil type, weed type and amount of chemical applied. Control is usually maintained longer in heavier soil types, while in sandy soils and gravel areas the length of effective control is much less.

Care should be exercised when selecting a chemical to use on driveways because washing of the chemical onto nearby lawns and gardens may occur. In situations where this may occur it is advisable to use one of the chemicals listed under SHORT TERM TOTAL VEGETATION CONTROL or DRIVEWAYS AND PATIOS.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Non selective control of all vegetation	ammonium sulphamate POISON IVY & BRUSH KILLER g/5 L (500 g/L)	200.000 to 250.000 g/5 L water 400.00 to 500.00 water	
	bromacil HYVAR X (80 WP) HYVAR X-L (240 g/L)	6.160 to 10.800 kg/ha 7.70 to 13.50 kg/ha 25.69 to 45.04 L/ha	Mullein is not adequately controlled by bromacil.
	bromacil/ diuron (1:1) KROVAR (80 WP)	11.200 to 14.400 kg/ha 14.00 to 18.00 kg/ha	
	diuron KARMEX (80 DF)	11.200 to 44.000 kg/ha 14.00 to 55.00 kg/ha	Plantain is not adequately controlled by diuron.
	hexazinone VELPAR (90 SP)	4.050 to 8.100 kg/ha 4.50 to 8.99 kg/ha	
	bromacil/ 2,4-D CALMIX PELLETS (3 PE)	20.000 to 40.000 kg/ha 250.00 to 500.00 kg/ha	Use higher rate for the more dense infestations of weeds.
	tebuthiuron SPIKE 80 WP (80 WP) SPIKE 5 G (5 Gr)	4.400 to 11.000 kg/ha 5.50 to 13.75 kg/ha 88.00 to 220.00 kg/ha	Field horsetail is not adequately controlled by tebuthiuron.

tebuthiuron SPIKE 80 WP (80 WP) plus diuron KARMEX (80 DF)	4.400 kg/ha 5.50 L/ha 8.800 kg/ha 11.00 L/ha	Provides total vegetation control for a 1 to 2 year period.
tebuthiuron SPIKE 80 WP (80 WP) plus diuron KARMEX (80 DF)	6.800 kg/ha 8.50 kg/ha 13.600 kg/ha 17.00 kg/ha	Provides total vegetation control for a 2 to 3 year period.

CAUTION: The above chemicals should not be used to treat areas that are close to gardens, desirable trees, etc. Since these chemicals will kill any plant that they contact, special care must be used in their application. If the area (for example, a driveway) is higher than a nearby lawn, the chemical may wash onto the lawn with the first rain. If trees or shrubs are feeding under the treated areas, the chemical may leach to their roots and cause injury.

VEGETATION CONTROL-SHORT TERM NON-SELECTIVE

Foliage Treatment Chemical Mowing

Chemicals offer an alternative to mowing in areas where top kill of low growing vegetation is desired. The chemicals listed below are first applied when the growth is about 15 cm high. Spray to runoff. Tall vegetation is more difficult to kill and can become an unsightly fire hazard when it dies.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Control of any emerged annual or perennial weeds	amitrole AMITROL-T (200 g/L) glyphosate ROUNDUP (356 g/L)	4.000 kg/ha 20.00 L/ha 1.780 to 2.490 kg/ha 5.00 to 7.00 L/ha	Amitrole, AMITROL-T, or glyphosate must be applied to actively growing foliage to be effective. Apply in sufficient water (200 to 400 L/ha) to thoroughly wet all foliage. With amitrole or AMITROL-T, newly formed leaves turn white before the plants die. The appearance of foliage injury may be delayed during cool conditions. Regrowth may occur from freshly germinating plants or from underground portions of perennial weeds. (Also see, SELECTIVE WEED CONTROL WITH WIPER APPLICATORS section.)
Top kill only of annual or perennial plants	paraquat GRAMOXONE (200 g/L) diquat REGLONE (200 g/L)	1.100 to 2.200 kg/ha 5.50 to 11.00 L/ha 0.550 to 1.100 kg/ha 2.75 to 5.50 L/ha	Diquat or paraquat should be used at the higher rates and in a high spray volume (1000 L/ha) for dense weed growth. For chemical mowing along roadsides and other areas where a scorch is desired, paraquat at 1.1. kg/ha will be adequate. Use 1 L/1000 L of AGRAL 90 as a wetting agent for best results.
	ammonium sulphamate POISON IVY & BRUSH KILLER (500 g/L)	70.000 kg/ha 140.00 L/ha	Apply in approximately 1000 L water per hectare. Thoroughly wet all foliage. Ammonium sulfamate is corrosive to metal, thus it is essential to thoroughly clean spray equipment after use.

WEED CONTROL IN DRY DITCHES

When ditches on roadsides, or in other locations, contain standing or moving water, herbicides should not be applied to emergent weeds without consulting the Ontario Ministry of the Environment regarding the need for a permit (see WATER WEEDS section). However, such permits are not normally necessary for the application of herbicides to control weeds adjacent to ditches or weeds in ditches when no water is present. But the following precautions should be taken:

1. Spray when ditch or stream contains no flowing water.
2. Avoid spraying directly onto water surface (violation of Pesticides Act, Water Resources Act).
3. Schedule spray programs so that extensive sections of stream bank or ditch bank are not sprayed at one time.
4. Work upstream rather than downstream along the stream bank or ditch ank.
5. Ascertain downstream water uses to avoid possible conflict with the rights of other landowners.

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Cattails	amitrole AMITROL-T (200 g/L)	9.000 to 11.000 kg/ha 45.00 to 55.00 L/ha	Apply in a minimum of 1000 L of water per hectare from the time that the cattails are formed until frost.
	glyphosate ROUNDUP (356 g/L)	2.490 to 4.270 kg/ha 7.00 to 12.00 L/ha	Apply during mid to late flowering stage (mid July to late August) when cattails are actively growing. For isolated spots use a 1% solution/1 L (product) in 100 L water and spray to wet all foliage but not to the point of runoff.
Bulrushes	paraquat GRAMOXONE (200 g/L)	1.100 to 2.200 kg/ha 5.50 to 11.00 L/ha	Apply in 750 to 1000 L water per hectare when the seed heads are forming - usually late July or August.
	2,4-D*	2.250 kg/ha	Apply as the LOW-VOLATILE ESTER in 750-1000 L water per hectare.

* *Additional formulations available. See Table 1*

Table 12. Susceptibility Of Woody Plants To Various Herbicides And Mixtures As Foliage Sprays Of 2,4-D, 2,4-D Mixtures, Ammonium Sulfamate, Fosamine Ammonium and Triclopyr

Common Name	2, 4-D	2,4-D Dichlorprop (1:1)	2,4-D Dicamba (2:1)	Ammonium sulfamate	Fosamine annonium	2,4-D Picloram (3.7:1)	Triclopyr
alder	S-I	S	S		S	S	S
arborvitae	R	R	S	S-I		S	
ash	R	S-I	I-R		S-I	I-R	S
barberry, common	I	S			S	S-I	
basswood	R	S	S		S	S	S
beech	R		I	S-I	S-I	S	S-I
birch	S	S	S	S		S	S
blackberry	R		I-R	I-S	S	S-I	S
blueberry	S	S	I-R	I	I	S	S-I
buckthorn	I-R		I-R	I		S	S
cedar	R	I-R	S	S-I		S	
cherry, black, red	S-I	S	S	S	S-I	S	S-I
cherry, choke	S-I	S	S	S	S	S	S
cranberry	S						
creeper, Virginia	S	S-I	S	R	S-I	S	
currants, wild	R		S	I			
dogwood	S-I	S		S-I	S	S	S
elderberry	S		S-I	S		S	S
elm	I	S-I	S	S-I	S-I	S	S-I
fir, balsam	R	S-I	S	S-I		S	
grape, wild	S	S	S			S	S
hardhack, spiraea	I			I		S	
hawthorn	I-R	S	I-S	I	S	S	S
hemlock	R			S-I		S	
hickory, black, shagbark	R	S-I	S	S-I	I		S
honeysuckle	S-I	S	S	S		S	
ironwood	R	S-I	S	I		S	S
juniper	R	I-R	S	I-R		S-I	
lilac	I-R			I		S	
locust, black	I			I		S	
locust, honey	S-I			I			
maple, Manitoba	S-I	S	S	S-I	S-I	S	S
maple, red	R	I-R	I-R	S-I	S-I	S	S-I
maple, silver	S-I			S		S	S
maple, sugar	R	S-I	I-R	S-I		S	S
oak, red	I	I-R	S	S	I-R	S-I	S
oak, white	I	S-I	S-I	S		S-I	
oak, bur	R-I		S		I-R	S	
pine	R	S-I	S	S	I-R	S	
plum, wild	I	S			S		
poison-ivy	I	S-I	S	S	I	S	S
poplar, aspeen	S	S	S	I		S	S
prickly-ash	R		S		S		S

Table 12. Susceptibility Of Woody Plants To Various Herbicides And Mixtures As Foliage Sprays Of 2,4-D, 2,4-D Mixtures, Ammonium Sulfamate, Fosamine Ammonium and Triclopyr

Common Name	**2, 4-D**	**2,4-D Dichlorprop (1:1)**	**2,4-D Dicamba (2:1)**	**Ammonium sulfamate**	**Fosamine annonium**	**2,4-D Picloram (3.7:1)**	**Triclopyr**
raspberry, wild	R	S	I	I-S	S		S
redbud rhododendron	R			R		R	S
rose, wild	R	I	S		S	S	S
sassafras	S-I			I-S			
sheep-laurel	I		S			I-S	S
spruce	R	I-R	S			S-I	
sumac, poison	S						S
sweet-fern	I		S	S-I	S-I		
viburnum	R			I			
walnut	S-I			S		S	
willow	S	S	S	S	S	S	S

S Susceptible. Adequate control obtained with one application.
I Intermediate. Retreatment is usually needed for adequate control.
R Resistant. Two or more applications may not be adequate.

WATER WEEDS (AQUATIC PLANTS)

A Permit to Purchase and/or Perform a Water Extermination must be obtained before a pesticide, for control of aquatic weeds, can be legally purchased and/or applied to surface waters in Ontario unless exempt).

An exemption from the permit requirement is made for "agriculturists" who wish to treat a water body wholly confined within their property and where there is no outflow, at any time, beyond their property limits.

For further information on licensing and permits, contact any Ministry of the Environment Regional Office or Ministry of the Environment, Pesticides Section, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5. Telephone (416) 323-5095.

Herbicides provide temporary control of nuisance aquatic vegetation. Alternate methods such as mechanical removal (Submergents), dredging or substrate alteration (drainage ditches) can provide longer term control. Management techniques for vegetation control in ponds include minimizing nutrient input, dredging excess sediment, logs and other organic debris, decreasing the surface to depth ratio and increasing the rate of pond turnover (flushing). Some aquatic plant and algae life should be accepted and tolerated as a vital component of a healthy ecosystem.

The use of herbicides may be complicated by the use of water by livestock or humans or by the presence of fish. If the water is flowing, the effect of the chemical on plant, animal, or fish life downstream must be considered. Flowing water, by diluting the herbicide, makes control less effective.

The vegetation also varies widely; species include completely submerged ones such as *Elodea* (Canada waterweed) and algae; free floating ones such as water lilies and emergent plants. Many emergents will grow equally well on the moist shoreline as when their lower stems and roots are in water. Where these emergent species have taken possession of the shoreline, control measures must embrace that area as well as the water.

Simazine can provide a season's control of algae in ponds having a minimum flow through. Simazine should not be applied to ponds used for irrigation.

Chara (muskgrass) is a gray green to green plant like algae, attached to the sediment, which in dense communities have a very strong musk odor. It is brittle to the touch and will dry to a white powder upon removal from the water. This plant is difficult to control with moderate doses of algicides and dense communities should be removed mechanically.

Tape grass(wild celery) (*Vallisneria americana*) found in many recreational lakes, is resistant to all the currently recommended herbicides. It has long rubber like leaves and numerous short roots. Control must be confined to mechanical methods such as pulling.

Diquat provides good control of a wide variety of submergent species including water-milfoil, pondweeds *Elodea*(Canada waterweed) and coontail. This herbicide is not effective against muskgrass (chara spp). Diquat should be applied on cloudy days in late afternoon and care should be taken not to stir up the bottom since turbidity reduces the effectivness of treatment. Since diquat takes effect rapidly, decomposition of a large plant mass may deplete oxygen levels which can cause fish to suffocate. Thus, in ponds where fish are present and growth is well established, no more than 1/4 to 1/2 of the pond should be treated at one time. Wait two weeks before treating again. The best time to apply these chemicals is late spring while the plants are growing rapidly. Since this is a contact chemical, control is achieved for one season, and repeat treatments must be made annually.

2,4-D ester (AQUA-KLEEN) consists of specially formed and hardened 2,4-D granules which sink rapidly to the bottom of lakes or ponds where release of chemical takes place. Muskgrass and tape grass are not controlled. Since this herbicide is systemic in action, collapse of the plant community may take 2-3 weeks. Treat in spring when growth is young and sparse. Apply as described above when large areas are treated. Control achieved is for one season. Caution: Do not use AQUA-KLEEN in mid July or early August, after plants have flowered. At least two successive treatments (one per year) will be required.

Emergent species such as cattails and bulrushes may have to be sprayed for 2 or 3 consecutive years to bring them under complete control. The chemicals for cattails and other emergents are sprayed so as to thoroughly wet all exposed foliage. Paraquat and amitrole are most effective when cattails are coming into head. Consult the manufacturer's directions.

Additional information may be obtained by contacting the Ministry of the Environment, Pesticides Section, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5. Telephone: (416) 323-5095.

ALGAE AND VASCULAR SUBMERGENTS

WEEDS	Generic Name TRADE NAME (Formulation)	Rate (Active) RATE PRODUCT	REMARKS (For more information, see "Notes on Chemicals" section.)
Filamentous algae, pond scums	copper citrate and gluconate ALGIMYCIN PLL-C (5 PE)	0.180 to 0.350 kg/1000 m³ 3.60 to 7.00 kg/1000 m³	Not for use in public waters or waters draining into public waters. Not for use in potable waters. To be applied to areas where algae is well established and growing vigorously. Do not apply in deep water. To avoid oxygen depletion, and possible fish suffocation, split treatment into 2 or 3 partial treatments. When making partial treatments, observe a 10-14 day waiting period between treatments.
	copper citrate and gluconate ALGIMYCIN PLL-C (LI) (50 g/L)	0.150 kg/1000m³ 3.00 L/1000 m³	Not for use in public waters or waters draining into public waters. Treat 1/3 of a pond at a time to avoid oxygen depletion. Wait 72 hours before treating the next section. Care must be taken where fish are present. Dilute product 1 to 4 with water before applying.
	copper ethanolamine CUTRINE PLUS (9 Sn)	0.170 kg/1000 m³ 1.89 L/1000 m³	Use only in water where there is no discharge from the property. Not for use in potable waters. No restrictions on fishing or swimming. Care should be taken if fish are present. When algae is dense make 3 partial treatments; observe 7-14 day waiting period between treatments. Dilute the product 1 to 9 with water before applying. Fish caution: Cutrine Plus is toxic to fish - extremely toxic in water of low hardness. Where water hardness is unknown do not use if fish are present.
	simazine PRINCEP NINE-T (90 WG) of water (no flow) simazine PRINCEP NINE-T (90 WG) of water where flow is minimal	0.450 kg/1000 m³ 5.00 g/10,000 L 0.900 kg/1000 m³ 10.00 g/10,000 L	For use in ponds where little (minimum) or no water flow through exists. Use the lower rate for ponds in which water flow has been closed off before treatment and will remain closed for 10 days after treatment. Water from treated ponds is not to be used for irrigation or human consumption. Fish taken from treated ponds should not be used for human consumption. Treat early before dense growth starts. To avoid oxygen depletion treat the pond in sections. Treated water coming in contact with grass or other vegetation may cause damage; willows and other shrubs growing around the pond may be injured.
	water soluble dyes AQUASHADE (26 Sn)	195.000 mL/1000 m³ 750.75 mL/1000 m³	For use in ponds with no outflow. Do not apply to water that will be used for drinking or other domestic purposes. Make application early in the growing season before algae and weed growth develop. Re-apply when the color of water fades or first new algae growth develops. Mechanically remove any heavy vegetation before applying Aquashade to avoid oxygen depletion and fish suffocation.
Submerged plant like algae: *Chara* and *Nitella* spp. in ponds	copper citrate and gluconate ALGIMYCIN PLL-C (5 PE)	1.125 to 2.250 kg/ha 22.50 to 45.00 kg/ha	For use in ponds wholly confined within the user's property and where there is no outflow beyond the property limits at any time. Use the lower rate if treated when the vegetation is young and actively growing. Higher rates are to be used later in the season as plants become more resistant. Where fish are present and plant stands are dense, divide the pond area into sections and treat sections at 10-14 day intervals. Also see footnote and REMARKS on previous page.

	copper ethanolamine CUTRINE PLUS (9% Li) 0.5 m - use 18.42 L/ha 1.0 m - use 36.84 L/ha 1.5 m - use 55.26 L/ha	0.320 kg/1000 m³	For use in ponds wholly confined within the user's property and where there is no outflow beyond the property limits at any time. In hard water CUTRINE PLUS is toxic to fish if 0.4 ppm is exceeded. If fish are present but water hardness is not known, do not use CUTRINE PLUS. Split treatments at 7-14 day intervals are recommended to avoid oxygen depletion where plant mass is dense. Dilute product 1 to 9 with water before applying. Also see footnote and REMARKS on previous page.
	simazine PRINCEP NINE-T (90 WG)	1.800 to 2.930 kg/1000 m³ 20.00 to 32.50 g/10,000 L	For use in ponds where little or no water flow through exists. Apply early in season to avoid oxygen depletion. Use lower rate for ponds where water flow has been shut off and will remain shut off for 10 days after treatment. Use the higher rate when heavy infestations occur. Do not use treated water for irrigation or human consumption. Do not use fish taken from treated water for human consumption. Willows and other shrubs bordering treated ponds may be injured.
Emerged and submerged rooted aquatic plants in ponds (pondweeds, Canada waterweed, duckweed, coontail, water moss, naiad, and milfoil)	simazine PRINCEP NINE-T (90 WG)	21.600 kg/ha 23.98 kg/ha	"Drawdown treatment" application should be made to exposed soil or mud when water level is lowered. Apply in the fall before freeze up or as early in the spring as possible. Do not raise water level until sufficient rainfall has occurred to carry the chemical into the soil. Also for beach areas above the waterline. Apply in the fall well before freeze up or as early in the spring as conditions permit. Discing after application will assist in controlling deeper rooted weeds.
	simazine PRINCEP NINE-T	0.900 kg/1000 m³ 10.00 g/10,000 L water	For use in ponds where little or no water flow through exists. Water flow to be shut off and remain so for 10 days after treatment. Do not use treated water for irrigation or human consumption. Fish taken from treated ponds should not be used for human consumption. Refer to simazine remark under Filamentous Algae (previous page).
Mixed submerged vascular plants in ponds, ditches, lakes, river canals, slow moving or still water	diquat(aquatic) REGLONE A (200 g/L)	4.400 to 7.000 kg/ha 22.00 to 35.00 L/ha	Do not use treated water for human or animal consumption or swimming for 24 hours. Do not use for irrigation for 5 days. To avoid oxygen depletion, treat only 1/4 to 1/3 of the area at a time. Apply at dusk in mid to late June when plants are young and growing vigorously. Tape grass and Chara are NOT controlled.
	2,4-D* AQUA-KLEEN (20 Gr)	22.000 to 45.000 kg/ha 110.00 to 225.00 kg/ha	Treat in spring or early summer when weeds are starting to grow. When weed mats are dense and water depth is over 2.4 metres, use the higher rate. *Read label carefully regarding restrictions on use of treated waters.* Tape grass and Chara are NOT controlled. CAUTION: Do not use AQUA-KLEEN within 1 kilometre of any water intake. See footnote.
Eurasian water milfoil in lakes	diquat(aquatic) REGLONE A (200 g/L)	2.200 kg/ha water surface 11.00 L/ha water surface	Treat when plants are in the very early stage of growth (June). See diquat note above.
	2,4-D* AQUA-KLEEN (20 Gr)	22.000 to 45.000 kg/ha 110.00 to 225.00 kg/ha	Treat in spring or early summer when weeds are starting to grow. When weed mats are dense and water depth is over 2.4 metres, use the higher rate. *Read label carefully regarding restrictions on use of treated waters.* Tape grass and Chara are NOT controlled. CAUTION: Do not use AQUA-KLEEN within 1 kilometre of any water intake. See footnote.

---

* *Where AQUA-KLEEN is used, do not use water from treated area for consumption by humans or livestock, or for irrigation of 2,4-D sensitive crops for at least 60 days after treatment in confined waters, or for at least 21 days after treatment in open bodies of water.*

Emergents			
Cattails, bulrushes and emerged grasses	paraquat GRAMOXONE (200 g/L)	1.100 to 2.200 kg/ha 5.50 to 11.00 L/ha	Do not use treated water for 7 days for swimming, human or animal consumption. Do not use for irrigation for 5 days. Do not apply to muddy water or agitate water excessively for 1-2 days after treatment. Treat cattails and bulrushes when plants are in flower. Avoid inhalation of spray mist; consult label for appropriate protective clothing. Apply in 850 to 1000 L/ha of water.
Cattails in non crop areas (roadsides, fencerows, ditch banks, drainage ditches)	amitrole AMITROL-T (200 g/L)	9.000 to 11.000 kg/ha 45.00 to 55.00 L/ha	Apply after catkins are fully formed and up to frost. Do not disturb sprayed plant. Do not apply where water will be used for irrigation, drinking or other domestic uses. Do not apply where water is not wholly confined to users property. Apply in 1000 L/ha of water.
Water lilies, water shield	2,4-D AQUA-KLEEN (20 Gr)	35.000 to 45.000 kg/ha 175.00 to 225.00 kg/ha	Repeat treatment for yellow water lily or spatterdock may be necessary. Treat in midsummer. CAUTION: Do not treat within 1 km of any water intake. See footnote on previous page.
Duckweed	diquat REGLONE (200 g/L)	4.400 kg/ha 22.00 L/ha	Apply by directed surface spray on foliage. Use 1 part REGLONE A with at least 4 parts of clean water. See REMARKS on previous page.

CAUTION: **Use of copper based algicides may be toxic to trout or other fish. To avoid suffocation of fish due to oxygen depletion from decaying vegetation treat ponds in sections and observe recommended time periods between partial treatments. Copper algicides may be used only in ponds where water is wholly confined within the property of the user and where there is no outflow beyond the property limits at any time.**

Table 13. Habitats And Herbicide Susceptibility Of Common Aquatic Plants

	spring-fed pond	dugout	soft water lake*	hard water lake**	wet ditch***	dry ditch****		1	2	3	4	5	6
ALGAE													
Spirogyra sp.	VC	VC	C-I		VC	I		S	S	R	R		
Ulothrix sp.	C	VC			VC			S	S	R	R		
Mougeotia sp.	C	VC			VC			S	S	R	R		
Cladophora sp.	VC	VC	C	VC	VC	VC		S	S	R	R		
Chara sp. (Muskgrass)	VC	I	C-I	VC-I	VC	R		S	S-I	R	R		
Nitella sp. (Stonewort)	I	R	VC	R	R	R		S	S-I	R	R		
SUGMERGENT MACROPHYTES													
Sago pondweed *(P. pectinatus)*	I	C-I		VC				R	S	S	S		
Curly-leaf pondweed *(P. crispus)*	C	VC		VC				R	S	S	S		
Bass weed *(P. amplifolius)*	R	C		C				R	S-I	I			
Richardson pondweed *(P. richardsonii)*				VC-C				R	S-I	S-I	S		
Flat-stemmed pondweed *(P. zosteriformis)*				C				R		S			
Other narrow-leaf pondweed *(Potamogeton sp.)*	I	C	C	VC-C				R	S	S	S		
Eurasian water milfoil *(Myriophyllum spicatum)*			VC					R	S	VS	VS		
Native milfoil *(M. exalbescens and others)*	C		C	VC				R	S	VS	VS		
Bladderwort *(Utricularia vulgaris)*		C		C				R	S	S-I	I		
Coontail *(Ceratophyllum demersum)*		C		VC				R	S-I	I	I		
Water stargrass *(Heterantheria dubia)*				C				R		S-I	VS		
Tape grass *(Vallisneria americana)*	R	I	C	VC	R	R	M**	R	R	R	R	R	R
Water naiad *(Najas flexilis)*		I		VC				R	S	S			
Canada water weed *(Elodea canadensis)*		C		VC				R	S-I	I	S-I		
EMERGENTS													
Cattails *(T. latifolia, T. angustifolia)*	VC	VC		VC	VC	I-C	M	R	R	R	R	I	S-I
Bulrush *(Scirpus spp.)*			C	VC	C	C	M	R					S-I
Sedge *(Carex sp.)*			C	C	C	VC	M	R					S-I
#Bur reed *(Sparganium spp.)*	C		C	C	C	VC	M	R					I
Water plantain *(Alisma spp.)*			I	C	C	VC		R					S
Pipewort *(Eriocaulon spp.)*	R	R	C	R	R	R	M*	R				S	
Arrowhead *(Sagittaria spp.)*		C		VC	I-C			R				S	
Pickerelweed *(Pontederia spp.)*			VC		I	R		R				S-I	
Water smartweed *(Polygonum amphibium)*	I	I						R				S-I	
Water shield *(Brasenia spp.)*			C					R			I	S-I	
White water lily *(Nymphaea spp.)*			C	C			M*	R			I	I	
Yellow water lily *(Nuphar spp.)*		C-I	C	C			M*	R			I	I	
Duckweed *(Lemna spp.)*	R	C	I-R	VC				R	S	S		S	
Duckmeal *(Wolffia spp.)*	R	C-I	I-R	VC				R		S		S	

VC - Very common   C - Common   I - Infrequent   R - Rare   S - Susceptible   I - Intermediate   R - Resistant
M Manual/mechanical methods equally as effective as herbicides.
M Manual/mechanical methods generally more effective than herbicides*
*M** Manual/mechanical methods are the only control measure currently available.*
# Bur reed is also very common as a submerged plant in ecotypes C and D.
** A typical Muskoka lake is an example of a soft water lake.*
*** A typical Kawartha lake is an example of a hard water lake.*
**** A wet ditch contains water at time of treatment.*
***** A dry ditch contains no water at time of treatment.*

1 Copper compound (Cutrine Plus, Algimycin PLL-C)
2 Simazine (PRINCEPT NINE-T)
3 Diquat (REGLONE A)
4 2.4-D granular (AQUA-KLEEN)
5 Paraquat (GRAMOXONE)
6 Amitrole (AMITROL-T)

Table 14. Classification Of Weeds According To Response To Various Foliage Sprays

Common Name	2,4-D	MCPA	2,4-DB or MCPB	Mecoprop	Dicamba
aster (perennial)	I				
bedstraw (perennial)	R	I-R	R	I	R
bellflower (perennial)	R				
bindweed, field (perennial)	I	I	I	I	S-I
blueweed (biennial)	S-I	I		I	I
bracken fern (perennial)	R	R	R	R	I
buckwheat, wild (annual)	I-R	I	I-R	I-R	S
burdock (biennial)	S	S	I		S
buttercup (perennial)	I-R	S-I	I**(I-R)	I	I
campion, bladder (perennial)	R	R	R	R	
carrot, wild (biennial)	S-R	S-R	R	I-R	S
catchfly, night-flowering (annual)	R	R	R	R	
catnip (perennial)	S-I				
chickweed, common (annual)	I-R	I	R	S	S
chickweed, mouse-eared (perennial)	I-R	I-R	R	S	S
chicory (perennial)	S	S-I	S-I*(R)	I-R	S
cinquefoil, rough (winter annual)	I				
cinquefoild, sulfer (upright c.), (perennial)	I				
cocklebur (annual)	S	S	S	S	S
cockle, purple (annual)	I-R	R	R		I
cockle, white (perennial)	R		I-R		I
daisy, ox-eye (perennial)	I	I	R	I	I
dandelion (perennial)	S	S	I*(R)	I	S
dock (perennial)	I	I	I	I	
evening-primrose (biennial)	S				
false flax (winter annual)	S	S	S	S	S
fleabane, annual (daisy f.) (winter annual)	I	I	S-I		
fleabane, Canada (annual)	S-I				
goat's-beard (biennial)	I				
goldenrod (perennial)	I	R	I	I	
goosefoot (annual)	S	S	S	S	
goutweed (perennial)	R	R	R	R	
grasses (annual and perennial)	R	R	R	R	
ground-ivy (Creeping Charlie) (perennial)	I-R	I-R		I	S
groundsel (annual)	I	I			
hawkweed (perennial)	I-R	I-R			S-I
heal-all (perennial)	I-R	I-R	I-R	S	S
hemp-nettle (annual)	R	S-I	I-R**(R)	R	
horse-nettle (perennial)	R				I
horsetail (perennial)	I-R	S-I	I-R	I-R	I
knapweeds (perennial)	R				I
knotweed (annual)	I-R		I*(I-R)	S-I	S
lady's-thumb (annual)	S-I	I-R	I-R*(R)	I-R	S
lamb's-quarters(annual)	S	S	S	S	S
lettuce, prickly (annual)	S-I	S	S	S	
mallow, round-leaved (perennial)	I-R	I-R	I-R	I-R	
mayweed (annual)	I-R		R		S
medick, black (winter annual)	I	I	I	S	I

Table 14. Classification Of Weeds According To Response To Various Foliage Sprays

Common Name	**2,4-D**	**MCPA**	**2,4-DB or MCPB**	**Mecoprop**	**Dicamba**
milkweed (perennial)	R	R	R	I-R	I-R
motherwort (perennial)	S-I				
mullein (biennial)	I-R				
mustards (annual)	S	S	I	S	
nightshade (perennial)	I-R			R	
parsnip, wild (biennial)	S				
pepper-grass, common (winter annual)	S	S-I	I		
pepper-grass, field (winter annual)	S	S	I		
pigweeds (annual)	S	I	S-I	S	S
pineappleweed (annual)	S		R	R	
plantains (perennial)	S	S	S-I	S-I	I
purslane (annual)	I	I	S-I	S-I	
ragweed (annual)	S	S	S	S	S
ragwort (biennial and perennial)	I-R	R	R	I	S-I
ribgrass (perennial) (see plantains)					
rocket, yellow (biennial)	S	I	I*(R)		
shepherd's purse (winter annual)	S-I	S	S-I	S-I	
smartweed, green (annual)	S-I	I-R	I-R	I-R	S
soreel, sheep (perennial)	I	R			
sow-thistle, annual (annual)	S	I	S-I	I	
sow-thistle, perennial (perennial)	I	R	S-I*(I-R)		S-I
speedwells (annual and perennial)	I-R	I-R		S-I	S-I
spurge, cypress (perennial)	I-R	I-R	I-R		I
spurge, leafy (perennial)	I-R	I-R	I-R	R	I
spurry, corn (annual)	R	I	R	I	S
St. John's-wort (perennial)	R	R	R	R	R
stinkweed (pennycress) (winter annual)	S	S	S-I	S	S
stonecrop, mossy (perennial)	I	I		S-I	
teasel (biennial)	S				
thistle, bull (biennial)	S	S	S	S	
thistle, Canada (perennial)	I	I	I	I	S-I
thistle, nodding (biennial)	I		I		
thistle, Russian (annual)	S-I		I-R	R	S-I
toadlfax (perennial)	R	R	R	R	
velvetleaf (annual)	S-I	I	S-I*(I-R)		S-I
vetch (perennial)	I-R	I-R	R	I-R	I
vetches, wild (annual)	S	S			
violet, field (field pansy) (annual)	R			R	
water-hemlock (perennial)	S-I				
wood-sorrel (perennial)	I-R				
yarrow (perennial)	R	I-R		I-R	I-R

* *2,4-DB more effective (susceptibility to MCPB in brackets)* ** *MCPB more effective (susceptibility to 2,4-DB in brackets)*

S *Susceptible - i.e., killed by 1 application of 2,4-D, MCPA, or Mecoprop (1.2 kg or less per hectare); or by 1 application of Dicamba (425 g or less per hectare).*

I *Intermediate - i.e., killed less rapidly but controlled either by higher rates or by repeated applications.*

R *Resistant - i.e., not, or only slightly damaged by chemical treatement. Control of this weed is not practical with herbicide(s) listed above this column.*

S-I *between susceptible and intermediate.*

I-R *between intermediate and resistant*

ONTARIO MINISTRY OF THE ENVIRONMENT

FIELD OFFICES

Central Region

Halton, Peel, York, Durham, Toronto, Simcoe, Muskoka
7 Overlea Blvd, 4th Floor
Toronto, M4H 1A8, (416) 424-3000

Peterborough, Victoria, Haliburton, Northumberland
139 George Street North
Peterborough, K9J 3G6, (705) 743-2972

Approvals Branch
3rd Floor 250 Davisville Avenue
Toronto, M4S 1H2, (416) 440-3713

Northeastern Region

Manitoulin, Nipissing, Parry Sound, Sudbury, Cochrane,
Timiskaming, Algoma
199 Larch Street
Sudbury, P3E 5P9, (705) 675-4501

Northwestern Region

Kenora, Rainy River, Thunder Bay
Ontario Government Building, 435 James Street South
Thunder Bay, P7C 5G6, (807) 475-1215

Southeastern Region

Frontenac, Hastings, Lennox & Addington, Prince Edward,
Leeds & Grenville
P.O. Box 820, 133 Dalton Street
Kingston, K7L 4X6, (613) 549-4000

Prescott & Russell, Renfrew, Stormont, Dundas &
Glengarry, Ottawa-Carleton, Lanark
2435 Holly Lane
Ottawa, K1V 7P1, (613) 521-3450

Southwestern Region

Elgin, Middlesex, Oxford
985 Adelaide Street South
London, N6E 1V3, (519) 661-2200

Essex, Kent, Lambton
P.O. Box 726, 435 Grand Avenue West
Chatham, N7M 5L1, (519) 354-2150

Bruce, Grey, Huron, Perth
P.O. Box 688, 20 King Street, OMAF Building
Clinton, N0M 1L0, (519) 482-3428

West Central Region

Haldimand, Norfolk, Niagara, Hamilton-Wentworth,
Dufferin, Wellington, Waterloo, Brant
Ontario Government Building, 119 King Street West
Hamilton, L8N 3Z9, (416) 521-7640

Head Office

Pesticides Section
135 St Clair Avenue West, Suite 100
Toronto, M4V 1P5, (416) 323-5095

PUBLICATIONS

The following publications are available from any of the Field Offices or from the Pesticides section, Hazardous Contaminants Co-ordination Branch, Ministry of the Environment, 135 St. Clair Avenue West, Toronto, Ontario M4V 1P5:

- Personal Protective Equipment for Pesticide Users
- Pesticides Safety handbook
- Pesticides Act
- Index of Agent Codes
- Guidelines for Storage, Disposal and Transportation of Pesticides
- Fires and Stored Pesticides
- Pesticide Spills

ONTARIO MINISTRY OF AGRICULTURE AND FOOD

FIELD OFFICES

Algoma 341 Trunk Road
Sault Ste. Marie, P6A 3S9, (705) 253-1161

Brant 515 Park Road North, Unit 7
Brantford, N3R 7K8, (519) 759-2190

Bruce 220 Trillium Court, RR # 3
Walkerton, N0G 2V0, (519) 881-3301

Carleton 26 Thorncliffe Place
Nepean, K2H 6L2, (613) 828-9167

Cochrane N. Experimental Farm
Kapuskasing, P5N 2X9, (705) 335-5828

Cochrane S. P.O. Box 680
Matheson, P0K 1N0, (705) 273-2509

Dufferin RR # 4
Orangeville, L9W 2Z1, (519) 941-3830

Dundas P.O. Box 488
Winchester, K0C 2K0, (613) 774-2313

Durham E. 71 Mearns Court
Bowmanville, L1C 4N4, (416) 623-3348

Durham W. P.O. Box 309
Uxbridge, L9P 1M8, (416) 852-3328

Elgin P.O. Box 2027, RR # 5
St. Thomas, N5P 3X1, (519) 631-4700

Essex 46 Fox Street
Essex, N8M 2S2, (519) 776-7361

Frontenac P.O. Box 651,
1055 Princess Street
Kingston, K7L 4X1, (613) 545-4360

Glengarry P.O. Box 579
Alexandria, K0C 1A0, (613) 545-1046

Grenville P.O. Box 2004
Kemptville, K0G 1J0, (613) 258-8295

Grey 181 Toronto Street South
Markdale, N0C 1H0, (519) 986-2040

Haldimand P.O. Box 129
Cayuga, N0A 1E0, (416) 772-3381

Halton 17 Wilson Drive
Milton, L9T 3J7, (416) 878-2314

Hastings P.O. Box 340
Stirling, K0K 3E0, (613) 395-3393

Huron P.O. Box 159
Clinton, N0M 1L0, (519) 482-3428

Kenora P.O. Box 3000,
Ontario Government Building
Dryden, P8N 3B3, (807) 223-2415

Kent P.O. Box 726,
435 Grand Avenue West
Chatham, N7M 5L1, (519) 354-2150

Lambton P.O. Box 730
Petrolia, N0N 1R0, (519) 882-0180

Lanark 10 Sunset Boulevard
Perth, K7H 2Y2, (613) 267-1063

Leeds P.O. Box 635
Brockville, K6V 5V8, (613) 342-2124

Lennox & Addington
41 Dundas Street West
Napanee, K7R 1Z5, (613) 354-3371

Manitoulin P.O. Box 328
Gore Bay, P0P 1H0, (705) 282-2043

Middlesex 50 King Street
London, N6A 2P2, (519) 434-6811

Muskoka P.O. Box 130,
8 Centre Street North
Huntsville, P0A 1K0, (705) 789-8886

Niagara N. Vineland Station,
L0R 2E0, (416) 562-4147

Niagara S. 726 Canboro Road
Fenwick, L0S 1C0, (416) 892-4741

Nipissing 222 McIntyre Street West
North Bay, P1B 2Y8, (705) 474-3050

Norfolk P.O. Box 587
Simcoe, N3Y 4N5, (519) 426-7120

Northumberland P.O. Box 8200
Brighton, K0K 1H0, (613) 475-1630

Oxford P.O. Box 666
Woodstock, N4S 7Z5, (519) 537-6621

Peel 35 Vankirk Drive Unit 9
Brampton, L7A 1A5, (416) 451-5474

Perth 413 Hibernia Street
Stratford, N5A 5W2, (519) 271-0280

Peterborough 55 George Street North
Peterborough, K9J 3G2, (705) 745-2403

Prescott P.O. Box 110
Plantagenet, K0B 1L0, (613) 673-5115

Prince Edward P.O. Box 470
Picton, K0K 2T0, (613) 476-3224

Rainy River P.O. Box 210, Front Street
Emo, P0W 1E0, (807) 482-2310

Renfrew 315 Raglan Street South
Renfrew, K7V 1R6, (613) 432-4841

Russell P.O. Box 540,
735 Rue Notre Dame
Embrun, K0A 1W1, (613) 443-3391

Simcoe N. P.O. Box 340
Elmvale, L0L 1P0, (705) 322-2231

Simcoe S. P.O. Box 370
Alliston, L0M 1A0, (705) 435-5521

Stormont P.O. Box 97
Avonmore, K0C 1C0, (613) 346-2143

Sudbury 1899 La Salle Boulevard
Sudbury, P3A 2A3, (705) 566-1630

Timiskaming P.O. Box G
New Liskeard, P0J 1P0, (705) 647-6701

Thunder Bay Ontario Government Building,
435 James Street South
Thunder Bay, P7E 6E3, (807) 475-1631

Victoria 322 Kent Street West
Lindsay, K9V 2Z9, (705) 324-6125

Waterloo 279 Weber Street North
Waterloo, N2J 3H8, (519) 884-5390

Wellington R.R. # 1
Fergus, N1M 2W3, (519) 846-0941

Wentworth R.R. # 1
Ancaster, L9G 3K9, (416) 527-2995

York 1110 Stellar Drive, Unit # 102
Newmarket, L3Y 7B7, (416) 895-4519

ONTARIO MINISTRY OF AGRICULTURE AND FOOD

PLANT INDUSTRY BRANCH - CROP ADVISORY SERVICE

Horticultural Crop Advisors

Agro-forestry

Clare Coons P.O. Box 2004,
Ontario Government Building
Kemptville, K0G 1J0, (613) 258-8301

Brant, Haldimand-Norfolk

Jody Bodnar Horticultural Research Station,
P.O. Box 587
Simcoe, N3Y 4N5, (519) 426-7120

Direct Farm Sales

Bob Cobbledick Vineland Station, L0R 2E0,
(416) 562-4147

Durham, Victoria, York

Tom Clarke 234 King Street East
Bowmanville, L1C 1P5, (416) 623-3348

Eastern Ontario

Kevin Schooley Kemptville College of Agricultural
and Food Technology
Kemptville, K0G 1J0, (613) 258-8359

Essex, Kent

Leslie Huffman Research Station
Harrow, N0R 1G0, (519) 738-2251

Grape and Wine Specialist

Josef Zimmerman
Vineland Station, L0R 2E0, (416) 562-4147

Greenhouse Flowers

Wayne Brown Vineland Station, L0R 2E0,
(416) 562-4142

John Hughes Department of Horticultural Science,
University of Guelph
Guelph, N1G 2W1, (519) 824-4120 (Ext. 8910)

Greenhouse Vegetables

Shalin Khasla Research Station
Harrow, N0R 1G0, (519) 738-2251

Halton, Wentworth, Wellington, Peel

Joe Uyenaka R.R. # 1
Ancaster, L3Y 3K9, (416) 527-2995

Kent, Essex

Anne Verhallen, Ed Tomecek
Ridgetown College of Agricultural and Food
Technology
Ridgetown, N0P 2C0, (519) 674-5456

Lambton, Middlesex, Huron

John Gardner 50 King Street
London, N6A 2P2, (519) 434-6811

Maple Syrup

John Butler P.O. Box 340
Elmvale, L0L 1P0, (705) 322-2231

N. York (Bradford Marsh)

Mary Ruth McDonald
Research Station, R.R. # 1
Kettleby, L0G 1J0, (416) 775-3783

Niagara

Burke McNeil, Maribeth Fitts
Vineland Station, L0R 2E0, (416) 562-4147

Northern Ontario

Barb MacLean 435 James Street South
Thunder Bay, P7E 6E3, (807) 475-1631

Northumberland, Peterborough

David Ridgway P.O. Box 340
Trenton, K8V 5R5, (613) 392-3527

Oxford, Elgin, Perth, Waterloo

Keith Priest P.O. Box 666
Woodstock, N4S 7Z5, (519) 537-6621

Potatoes

Sam Squire P.O. Box 370
Alliston, L0M 1A0, (705) 435-5521

Prince Edward, Hastings, Lennox & Addington, Frontenac

Allan Moynes P.O. Box 470
Picton, K0K 2T0, (613) 476-3224

Simcoe, Dufferin, Grey

Ken Wilson P.O. Box 69
Clarksburg, N0H 1J0, (519) 599-2042

Turfgrass

Vacant Department of Horticultural Science,
University of Guelph
Guelph, N1G 2W1, (519) 824-4120 (Ext. 2597)

ONTARIO MINISTRY OF AGRICULTURE AND FOOD

PLANT INDUSTRY BRANCH - CROP ADVISORY SERVICE

Soils and Crops Specialists

Bruce

Keith Reid 220 Trillium Court, R.R. # 3
Walkerton, N0G 2V0, (519) 881-3301

Durham, Victoria-Haliburton

Neil Moore 322 Kent Street West
Lindsay, K7H 2Y2, (705) 324-6125

Elgin

Hugh Martin P.O. Box 2027
St. Thomas, N5R 3X1, (519) 631-4700

Essex

Bill Stevens 46 Fox Street
Essex, N8M 2S2, (519) 776-7361

Grey, Dufferin

Joan McKinlay 181 Toronto Street
Markdale, N0C 1H0, (519) 986-2040

Huron

Alan McCallum P.O. Box 159
Clinton, N0M 1L0, (519) 482-3428

Kent

Vacant College of Agricultural Technology
Ridgetown, N0P 2C0, (519) 674-5456

Lambton

Gabrielle Ferguso P.O. Box 730
Petrolia, N0N 1R0, (519) 882-0180

Leeds, Grenville, Lanark

Michael Payne 10 Sunset Boulevard
Perth, K7H 2Y2, (613) 267-1063

Middlesex

Peter Johnson 50 King Street
London, N6A 2P2, (519) 434-6811

Niagara N. & S., Haldimand

Jerry Winnicki 726 Canboro Road
Fenwick, L0S 1C0, (416) 892-4741

Norfolk, Brant

John Harvey P.O. Box 587
Simcoe, N3Y 4N5, (519) 426-7120

Northern Ontario

Daniel Tassé New Liskeard College of Agricultural
and Food Technology
New Liskeard, P0J 1P0, (705) 647-6701

Oxford

Chris Brown P.O. Box 666
Woodstock, N4S 7Z5, (519) 537-6621

Pasture Management Specialist

Susan Robinson P.O. Box 340
Stirling, K0K 3E0, (613) 395-3393

Pature Technician

Wilf Shier P.O. Box 340
Stirling, K0K 3E0, (613) 395-3393

Perth

Rob Templeman 413 Hibernia Street
Stratford, N5A 5W2, (519) 271-0280

Pest Management Advisor

Albert Tenuta Ridgetown College of Agricultural and
Food Technology
Ridgetown, N0P 2C0, (519) 674-5456

Tom Hartman Centralia College of Agricultural and
Food Technology
Huron Park, N0M 1Y0, (519) 228-6691

Peng Gang P.O. Box 340
Stirling, K0K 3E0, (613) 395-3393

Peterborough, Hastings, Northumberland

Jack Kyle 55 George Street North
Peterborough, K9J 3G2, (705) 745-2403

Prescott, Russell

Paul Beaudin P.O. Box 110
Plantagenet, K0B 1L0, (613) 673-5115

Prince Edward, Lennox & Addington, Frontenac

Stephen Clare P.O. Box 470
Picton, K0K 2T0, (613) 476-3224

Renfrew, Carleton

Paul Sullivan 26 Thorncliffe Place
Nepean, K2H 6L2, (613) 828-9167

Simcoe, North and South

Dave Morris P.O. Box 370
Alliston, L0M 1A0, (705) 435-5521

Stormont, Dundas, Glengarry

Gilles Quesnel P.O. Box 2004,
Ontario Government Building
Kemptville, K0G 1J0, (613) 258-8304

Wellington, Waterloo

Harvey Wright C/O Crop Science, University of Guelph
Guelph, N12 2W1, (519) 824-4120 (Ext. 6763)

Wentworth, Halton

Mark Janiec 17 Wilson Drive
Milton, L9T 3J7, (416) 878-2314

ONTARIO MINISTRY OF AGRICULTURE AND FOOD

COLLEGES OF AGRICULTURAL AND FOOD TECHNOLOGY

Alfred College of Agricultural and Food Technology
Alfred, K0B 1A0, (613) 679-2218

Centralia College of Agricultural Technology
Huron Park, N0M 1Y0, (519) 228-6691

Kemptville College of Agricultural and Food Technology
Kemptville, K0G 1J0, (613) 258-8336

New Liskeard College of Agricultural and Food Technology
New Liskeard, P0J 1P0, (705) 647-6738

Ridgetown College of Agricultural and Food Technology
Ridgetown, N0P 2C0, (519) 674-5456

HORTICULTURAL RESEARCH INSTITUTE OF ONTARIO

Muck Research Station
R.R. # 1
Kettleby', L0G 1J0, (416) 775-3783

Simcoe Station
Simcoe, N3Y 4N5, (519) 426-7120

Vineland Station
Vineland Station, L0R 2E0, (416) 562-4141

ONTARIO MINISTRY OF AGRICULTURE AND FOOD

AGRICULTURAL AND FOOD LABORATORY SERVICE BRANCH

Provincial Pesticide Residue Testing Laboratory
Guelph, N1H 2W1, (519) 823-8800

AGRICULTURE CANADA

RESEARCH STATIONS

Delhi Research Station
Delhi, N4B 2W9, (519) 582-1950

Harrow Research Station
Harrow, N0R 1G0, (519) 738-2251

London Research Centre
1400 Western Road
London, N6G 2V4, (519) 645-4452

Smithfield Experimental Farm
P.O. Box 340
Trenton, K8V 5R5, (613) 392-3527

Vineland Research Station
Vineland, L0R 2E0, (416) 562-4113

AGRICULTURE CANADA

FOOD PRODUCTION AND INSPECTION BRANCH

Belleville Office
228 Dundas Street East, Room 206
Belleville, K8N 1E4, (613) 969-3333

Chatham Office P.O. Box 392, 48 5th Street
Chatham, N7M 5K5, (519) 352-4390

Guelph Office 174 Stone Road West
Guelph, N1G 4S9, (519) 837-9400

London Office P.O. Box 577, Postal Station B
London, N6A 4W8, (519) 645-4021

Niagara Falls Office P.O. Box 35
Niagara Falls, L2E 6S8, (416) 357-5981

Ottawa Office 62 Auriga Drive, Room 156-B, Unit # 1
Nepean, K2E 7W6, (613) 998-9926

Peterborough Office P.O. Box 972
Peterborough, K9J 7A5, (705) 743-2931

Toronto Office
150 Bridgeland Avenue, Suite 111
Toronto, M6A 3A6, (416) 781-6186

PRECAUTIONS WITH ALL PESTICIDES

Read this entire section before using any pesticides.

GENERAL PRECAUTIONS

1. Always read the label before opening pesticide containers, and follow all precautions and directions. Before starting, keep a record of the common names of all pesticides handled and especially those listed as hazardous in this publication. This list should be known by members of your family for use in the event of an accident.
2. Use an anti-flowback device, to prevent back siphoning, when drawing water from wells, ponds, streams and other sources of water. Mix pesticide into the tank with sprayer at least 50 m from the water source. Triple or pressure rinse the empty container and add rinse water to tank. Only mix enough solution to do the spray job. After loading and mixing, wash down gloves and boots with clean water before removing.
3. Never smoke, chew tobacco or eat while handling or applying pesticides. Do not carry tobacco or food items in clothes worn while spraying. Change clothing and wash before eating.
4. When handling and mixing pesticide concentrates, rinsing empty containers or repairing leaks, a full set of protective clothing should be worn including waterproof cap, coveralls, impervious gloves and boots and eye protectors. If highly or extremely toxic pesticides are being used a respirator should be worn. If very dusty formulations are being handled, a dust mask should be used. If volatiles or gases are being handled, a respirator must be worn. If these gases are highly dangerous, or in an enclosed space, a self-contained breathing apparatus may be needed.
5. During application, a tractor cab with charcoal filters gives adequate protection against exposure. Impervious gloves, boots, coveralls and cap should be worn when tending to stoppages. When using airblast and mist blowers and tractors without cabs, waterproof suits including caps and impervious gloves and boots should be worn. When applying fumigants in the field, a respirator should be available for problems with equipment or if the fumigant is not adequately sealed in the soil and escapes.
6. When the spray operation is complete, take a bath or shower after spraying to remove pesticide deposits on the skin. Avoid handling anything in the home before bathing.
7. Well, pond and surface water may be contaminated by pesticides. Every effort should be made to keep this from happening. For more details see OMAF Factsheets 88-083 (Agdex 607) *Management of Pesticides on the Farm*, 86-077 (Agdex 607) *Pesticide contamination of Farm Water Supplies* and 87-044 (Agdex 607) *Guide to Handling and Applying Herbicide to Protect Water Supplies and Reduce Personal Exposure.*

It is an offense to contaminate surface waters with pesticides. To prevent this from occurring:

- Keep pesticide concentrates above flood plain in a locked storage.
- After emptying containers triple or pressure rinse, crush and dispose of at any appropriate landfill site.
- Mix concentrate and water at least 50 m away from any water supply.
- Use appropriate buffer zones and berms to avoid surface water contamination of wells, ponds and streams.
- If possible, do not use drinking water sources to fill spray equipment.
- Do not spray within 10 m of shallow wells or 5-10 m of other water water supplies under ideal conditions and increase these distances if there is any air movement. Stop spraying when wind velocity reaches 10 km/hr.
- There are government programs to protect your water supplies and assist in building pesticide storage facilities.

IF ACCIDENTS OCCUR

1. If an accident occurs, remove contaminated clothing including underclothes immediately and wash contaminated skin thoroughly with soap and water.
2. If clothing becomes wet with pesticide, during spraying, remove it immediately, wash and put on freshly laundered clothes.
3. If symptoms of illness occur during or shortly after handling or applying a pesticide, get the patient to a hospital immediately. Take the list of common name chemicals with you to the hospital (see Emergency Procedures for Pesticides Poisoning on the inside back cover).
4. Clean up any pesticide spills immediately. In case of minor spills, use dry soil or other absorbant material to remove excess liquid and sweep up powders and granulars. Contaminated soil and sweepings should be spread over a larger area of bare soil to facilitate rapid degradation. Make sure you are adequately protected when cleaning up the spill.
   IN CASE OF A MAJOR PESTICIDE "SPILL" THE MINISTRY OF THE ENVIRONMENT, SPILLS ACTION CENTRE, 5TH FLOOR, 7 OVERLEA BLVD., TORONTO, ONTARIO M4H 1A8, TELEPHONE (416) 965-9619 OR 1-800-268-6060 MUST BE NOTIFIED.
5. If a well becomes contaminated, follow clean up instructions in OMAF Factsheet, *Pesticide Contamination of Farm Water Supplies*, Agdex 607.

EMERGENCY PROCEDURES FOR PESTICIDE POISONING + FIRST AID INFORMATION

(See Inside Back Cover)

RELATIVE TOXICITY TO APPLICATOR

Definitions

Lethal Dose 50% (LD_{50}): The dose which when administered will kill 50% of the test animals within a stated period of time (i.e. 1 to 6 days).

Acute Toxicity

Immediate adverse effects from a single or short period exposure to a substance, either by the oral, dermal or inhalation routes.

Chronic Tocity

Adverse effects resulting from repeated exposure to a substance over an extended period.

High Acute Toxicity

These pesticides are extremely dangerous if handled carelessly. The acute oral LD_{50} is less than 50 mg/kg of body weight and the acute dermal LD_{50} less than 200 mg/kg body weight. These pesticides can be fatal by swallowing less than 0.1 to 3 mL (one drop to half a teaspoonful). These pesticides carry the skull and crossbones in a stop sign. In using these products, a respirator and eye protection is required along with all other protective clothing:

methyl bromide (MC-2, MB-C2)

Moderate Acute Toxicity

These pesticides are dangerous if handled carelessly. The acute oral LD_{50} is 50 to 500 mg/kg of body weight and the acute dermal LD_{50} is 200 to 2000 mg/kg body weight. These pesticides can be fatal by swallowing 3 to 30 mL (half a teaspoonful to 2 tablespoonfuls). These pesticides carry the skull and crossbones on a stop sign. In using these products, a respirator and eye protection are recommended, when handling the concentrate along with all other protective clothing:

bromoxynil (Bromox, Buctril, Pardner)
cyanazine (Bladex)
dazomet (Basamid)
1.3-D (Vorlex plus, Vorlex plus CP)

Low Acute Toxicity

These pesticides are not fatal unless deliberately ingested in amounts of over 30 mL (1 oz.). The acute oral LD_{50} is greater than 500 mg/kg body weight and the acute dermal LD_{50} is greater than 2000 mg/kg body weight. Pesticides listed in this publication and not appearing in the lists in this section have low acute toxicities and should be handled with caution. Protective clothing is required. Respirators are advised when pesticides are used in confined spaces. Eye protection is advisable and other protective clothing should be worn.

Chronic Toxicity

It is not possible to assess chronic toxicity of a pesticide in the same way as an LD_{50} is used to determine acute toxicity. Instead, a number of tests are performed on animals which help predict whether a pesticide will cause a number of possible long term effects. Animals are examined for a wide variety of toxic effects such as the production of tumors or abnormalities. Protective clothing and equipment is advisable to reduce exposure and the risk of chronic effects.

1,3-D (Vorlex plus, Vorlex plus CP)

PROTECTIVE CLOTHING WHEN USING PESTICIDES OUTDOORS

1. Why use Personal Protection? Pesticide formulations vary in their toxicity from slightly to extremely poisonous. Once the pesticide is removed from the container, exposure occurs. The toxicity of the pesticide and the exposure to the user creates a hazard which varies from spray operation to spray operation. Both can be reduced, i.e., toxicity by dilution and exposure by the use of protective clothing. The action taken by the applicator to reduce the hazard of a spray operation reduces the risk of poisoning. While the hazard of such a situation remains, the risk can be reduced by the care and protection followed by the applicator. Wearing the required protective clothing will reduce the risk.

2. Risk of each stage in pesticide operation

(1) Handling and mixing concentrate - very high risk
(2) Rinsing empty containers - high risk
(3) Application outdoors - low to high risk
(4) Application indoors - medium to very high risk
(5) Clean up, equipment rinsing - medium to high risk
(6) Reentry into treated area up to 48 hours - low to medium risk

3. Exposure can be by way of skin, eyes, mouth or nose. Approximately 80-85% of the exposure in most sprays operations is during mixing and loading of the concentrate. Field application usually accounts for 15-20% of the exposure. Skin exposure is usually 90-100% of the total exposure and around 70% of this is by way of the hands and forarms and 30% involves the rest of the body. Inhalation (nose and mouth) exposure is normally 0.1% but increases to 5-10% with mist blowers and air blast sprayers.

4. To reduce skin (dermal) exposure wear impervious gloves (neoprene, rubber, etc.) and waterproof boots, along with coveralls, apron or spray suits and waterproof cap. Coveralls can be reuable or disposable. Reusable coveralls are normally cotton or polyester and should be tightly wovern. Polyester is more easily penetrated than cotton. Disposable coveralls are polyethylene and can be laundered several times. Spray suits should be used in highly hazardous conditions as with mist blowers and air blast machines. Eye protection should be practised with all pesticide concentrates.

5. Respirators are recommended when handling pesticides with labels carrying the warning stop sign with skull and crossbones that call for respiratory protection. Respirators should be used when spraying all pesticides rated as high toxicity or applying any liquified gas. Respirators are available as air purifiers or self contained units. Respirators come in a wide range of shapes and sizes; consult the label and your nearest safety supply company for advice.

6. Washing and Laundering Protective Clothing. To keep your protective clothing and equipment functional, clean it thoroughly. Never allow children or pets to come into contact with contaminated clothing or equipment. Launder clothing promptly, wash and store other items used for personal protection. Rinse down spray equipment and store securely. Keep out of children's reach. General guidelines for cleaning items used for personal protection area as follows:

Fabric Clothing. If fabric clothing is saturated with the concentrate of a highly toxic pesticide, then discard the clothing. Remove the clothing carefully and immediately place in a plastic trash bag and dispose in a safe manner. Wear rubber, vinyl, or plastic gloves when handling severely contaminated clothing. Presoak and double launder clothes that may have been contaminated by normal spray operation preferably twice a day but at least at the end of the work day, following these guidelines:

- prerinse clothing outdoors by spraying or hosing down (solvent based products have been found to be effective on EC formulations).
- presoak in a suitable container such as large bucket or tub; or use the prewash cycle of an automatic washer with detergent.
- wash contaminated clothing separately from all other clothing.
- wash clothes using hot water, the highest water level, and a regular hot super wash cycle.
- use adequate amounts of heavy duty detergents for all pesticides (see label on detergent container).
- wash only a few contaminated garments at a time.
- use two complete wash cycles each with a double rinse.
- after washing contaminated clothing run another wash cycle with only detergent and water to decontaminate the washing machine.
- line dry to avoid a potential build up of pesticide residues in the dryer.

Rubber, vinyl, or plastic boots and gloves. To avoid getting pesticide on your hands, wash the outside of boots and gloves with detergent and water before removing. Wash boots and gloves inside and out with detergent and water, rinse thoroughly, and dry in a well ventilated area.

Chemical resistant clothing, goggles and face masks. Wash plastic or rubber clothing and equipment with detergent and water, rinse thoroughly, and dry in a well ventilated area.

Respirators. Discard cartridges, canisters and filter pads either (1) when breathing becomes difficult, (2) when a pesticide odor is noticed, or (3) at the time interval specified by the manufacturer. Write the date on the cartridge when it is first used. Wash the face piece in detergent and water, rinse thoroughly, and dry in a well ventilated area. Never use alcohol or other solvents for cleaning to prevent damage of rubber and plastic compounds.

7. Consult the safety supply house of your choice for appropriate guidance and selection of your protective clothing. For further details, see the Safety Supply Companies listed in the manual for the "Grower Pesticide Safety Course" or telephone 1-800-265-2950 ext 359.

PROTECTIVE CLOTHING WHEN USING PESTICIDES IN GREENHOUSES, MUSHROOM HOUSES, GRAIN STORAGES AND OTHER ENCLOSED AREAS

Respiratory Protection - Available Devices

Air Purifying Devices - Canister Gas Masks

Canister gas masks have been used effectively for many years by greenhouse applicators for respiratory protections against certain gases, vapors and particulate matter which otherwise might be harmful to life or health. From a practical standpoint, canister gas masks are generally suitable for ventilated areas not subject to rapid change in oxygen content, but should never be used in confined spaces where oxygen deficiency and high gas concentrations may occur.

Self Contained Breathing Apparatus

In confined spaces where gas concentrations are usually high, oxygen can be deficient and conditions can be fatal. Under these conditions air purifying devices fail to work. The applicator needs an air supply which can be provided by a self contained breathing apparatus, e.g. Scott Air Pack. The use of substances that produce hydrogen cyanide, methyl bromide, chloropicrin, or phosphine can all produce high gas concentrations and oxygen deficiency as can smoke generators and even foggers using highly toxic pesticides and some volatile sprays. Greenhouse and mushroom house operators need this type of apparatus if using these toxic gases, smokes, fogs or sprays.

Other Protective Clothing

Wear other protective clothing in keeping with the requirement on the label.

Working Conditions

Low Concentrations

Canister gas masks may be used when the surrounding air contains low concentrations of toxic gases, vapors or particulate matter derived from soil drench, granular dust and foliar spray applications. Pesticides applied in such a manner are usually of moderate to low toxicity. Contact your safety supply company for the proper canister selection.

High Concentrations

Use only a self contained breathing apparatus, e.g., Scott Air Pack, in the following instances when high concentrations are produced.

High concentrations of toxic gases, vapors or particulate matter can be produced when applying highly toxic pesticides such as:

1. When fumigating grain - methyl bromide
2. When fumigating soil - methyl bromide,
   1,3-D Dichloropropene
   (Telone and Vorlex)

Contact your safety supply company for their recommendation for each.

SPACE FUMIGANTS AND INSECTICIDE SMOKES

General

When using fumigants or insecticide smoke generators, wear appropriate protective clothing to prevent skin and inhalation exposure. After treatment lock the building where the extermination is being performed and post warning sign. Follow instructions on the product label regarding aeration of treated buildings, warehouses, grain storage bins or areas and greenhouses before permitting reentry. BECOME FULLY

AWARE OF THE HEALTH HAZARDS AND TOXIC PROPERTIES OF THE PESTICIDE YOU ARE USING.

Fumigants

An agriculturalist using methyl bromide, methyl bromide plus chloropicrin or aluminum phosphide to fumigate greenhouses, vaults, warehouses, and grain storage must obtain a permit issued under the Pesticides Act.

To apply for a permit contact the local Pesticide Officer with the Ministry of the Environment.

When handling methyl bromide, **do not** wear any gloves because these will trap gas close to the skin. A full face respirator with organic vapor canister or positive pressure breathing apparatus must be worn. A second person with personal protective equipment should be assisting during the fumigation. Refer to the Notes on Chemicals section for detailed use of methyl bromide.

When handling aluminum phosphide, the use of cotton gloves is recommended. A full face mask respirator with an acid gas canister should be worn. A second person with personal protective equipment should be assisting during the fumigation. Always consult the product label.

For further information, obtain *Methyl Bromide Structure Fumigation Procedures and Aluminum Phosphide Structure Fumigation Procedures* from the Ministry of the Environment offices.

STORAGE

1. General Storage

The Ontario Pesticides Act and Regulation 751 requires that all pesticides (schedules 1,2,3,4,5 and 6) be kept out of the reach of children, irresponsible persons, pets and livestock. They should be stored in a locked facility away from food for humans and feed for animals. Herbicides should be stored separately from other pesticides to avoid possible contamination. A warning sign must be prominantly displayed at entrances bearing the words **"Chemical Storage Warning - Authorzied Persons Only"**. A list of emergency telephone numbers including those of the local fire department, hospital and poison control centre must be prominently displayed.

2. Special Storage

(a) **All persons** must ensure that Schedule 1,2 and 5 pesticides are stored in a lockable storage facility which is ventilated to the outside atmosphere. A placard bearing the words **"CHEMICAL STORAGE WARNING - AUTHORIZED PERSONS ONLY"** in block capitals must be affixed to the outside of each entrance. Entry to the storage facility should only be made by the person responsible for the pesticide or with his permission.

(b) In addition to the requirement of (a), **Vendors, Operators, Exterminators and Agriculturalists** must store Schedule 1,2 and 5 pesticides in an area that has no floor drain that leads into or drains directly or indirectly into a storm sewer, sanitary sewer or water course; and near which adequate respiratory protection and adequate protective clothing are kept readily available for emergency purposes.

(c) **Always store pesticides in original containers and keep them tightly closed. Never put pesticides in unmarked containers.** See also OMAF Factsheet, *Farm Storage of Pesticides*, Agdex 607.

(d) In areas where flooding has been a frequent occurrence, fertilizers and pesticides must be stored above the known highwater mark to avoid contamination of the flood waters. Contamination of water by these chemicals can and has led to serious health problems affecting humans and domestic animals as well as fish and wildlife.

(e) To avoid carryover, pesticides should be purchased in quantities that can be used in one season. If however winter storage is necessary, care should be taken in storage temperature. Pesticides have differing tolerance to low temperatures and it is imperative that some pesticides are **not allowed to freeze**. Precautions on freezing are included in Table 1, and the product label where applicable. Be certain to follow guidelines for appropriate pesticide storage facilities.

DISPOSAL OF PESTICIDE CONTAINERS AND CONTAMINATED MATERIAL

1. All paper or cardboard pesticide containers, paper packaging material and any paper or other material used to clean up spills should be buried or burned. If containers are burned, ensure that people and animals are kept away from the smoke and that the smoke is not directed toward buildings, highways, roads, or public outdoor areas. **Plastic material must not be burned.**

2. Unrinsed containers can contain as much as 3% of the original formulation. If this amount of toxic pesticide is discarded with the container it could be dangerous to other people handling it or to the environment (for example, your water supply). Failure to rinse is also wasteful - why not use that 3% for the purpose for which it was purchased, to control the pest.
   Rinse all empty metal, plastic or glass containers three times with water and add washings to the spray tank, or, use a rinsing device. These rinsers can be used to puncture the bottom of a metal or plastic drum, and to rinse the residue left in the container directly into the spray tank. This procedure takes less than a minute. The rinsed containers should be crushed, buried and covered by at least 50 cm of soil, away from any watercourse or water table at an appropriate landfill site.

3. Excess, outdated or unusable pesticide material may be disposed of through a recognized disposal company such as Tricil Environmental Management (1-800-263-2432) or by contracting the appropriate registrant to develop an alternative method acceptable to the Director under the Pesticides Act (1-416-323-5095).

THE METRIC SYSTEM

Linear Measures (length)

10 millimetres(mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1000 metres (m) = 1 kilometre (km)

Square Measures (area)

100 m x 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measure

1000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid Measure

1000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)

Weight Volume Equivalents (for water)

(1.00 kg) 1000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)

Weight Measures

1000 milligrams (mg) = 1 gram (g)
1000 g = 1 kilogram (kg)
1000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)

Dry - Liquid Equivalents

1 cm^3 = mL
1 m^3 = 1000 L

APPLICATION RATE CONVERSIONS (approximate)

Metric to Imperial (Approximate)

litres per hectare x 0.09 = gallons per acre
litres per hectare x 0.36 = quarts per acre
litres per hectare x 0.71 = pints per acre
millilitres per hectare x 0.015 = fluid ounces per acre
grams per hectare x 0.015 = ounces per acre
kilograms per hectare x 0.89 = pounds per acre
tonnes per hectare x 0.45 = tons per acre

Imperial to Metric (Approximate)

gallons per acres x 11.23 = litres per hectare (L/ha)
quarts per acre x 2.8 = litres per hectare (L/ha)
pints per acre x 1.4 = litres per hectare (L/ha)
fluid ounces per acre x 70 = millilitres per hectare (mL/ha)
tons per acre x 2.24 = tonnes per hectare (t/ha)
pounds per acre x 1.12 = kilograms per hectare (kg/ha)
ounces per acre x 70 = grams per hectare (g/ha)

Dry Weight Equivalents

Grams or Killograms per Hectare	Approximate Ounces or Pounds per Acre
100 grams	= 1 1/2 ounces
200 grams	= 3 ounces
300 grams	= 4 1/4 ounces
500 grams	= 7 ounces
700 grams	= 10 ounces
1.10 kilograms	= 1 pound
1.50 kilograms	= 1 1/4 pounds
2.00 kilograms	= 1 3/4 pounds
2.50 kilograms	= 2 1/4 pounds
3.25 kilograms	= 3 pounds
4.00 kilograms	= 3 1/2 pounds
5.00 kilograms	= 4 1/2 pounds
6.00 kilograms	= 5 1/4 pounds
7.50 kilograms	= 6 3/4 pounds
9.00 kilograms	= 8 pounds
11.00 kilograms	= 10 pounds
13.00 kilograms	= 11 1/2 pounds
15.00 kilograms	= 13 1/2 pounds

Liquid Equivalents

Litres/Hectare = Approximate Gallons/Acre
50= 5
100= 10
150= 15

Litres/Hectare = Approximate Gallons/Acre
200= 20
250= 25
300= 30

CONVERSION TABLES METRIC TO IMPERIAL

Length

1 millimetre (mm)	= 0.04 inches
1 centimetre (cm)	= 0.40 inches
1 metre (m)	= 39.40 inches
1 metre (m)	= 3.28 feet
1 metre (m)	= 1.09 yards
1 kilometre	= 0.62 mile

Volume (liquid)

1 millilitre (mL)	= 0.035 fluid ounces
1 litre (L)	= 1.76 pints
1 litre (L)	= 0.88 quart
1 litre (L)	= 0.22 gallon (Imperial)
1 litre (L)	= 0.26 gallon (U.S.)

Weight

1 gram (g)	= 0.035 ounces
1 kilogram (kg)	= 2.21 pounds
1 tonne (t)	= 1.10 short tons
1 tonne (t)	= 2205 pounds

Pressure

1 kilopascal (kPa)	= 0.15 pounds/square inch

Area

1 square centimetre (cm^2)	= 0.16 square inch
1 square metre (m^2)	= 1.20 square yards
1 square kilometre (km^2)	= 0.39 square mile
1 hectare (ha)	= 107,636 square feet
1 hectare (ha)	= 2.5 acres

Volume (dry)

1 cubic centimetre (cm^3)	= 0.061 cubic inch
1 cubic metre (m^3)	= 1.31 cubic yards
1 cubic metre (m^3)	= 35.31 cubic feet
1000 cubic metres (m^3)	= 0.81 acrefoot
1 hectolitre (hL)	= 2.8 bushels

Speed

1 metre per second	= 3.28 feet per second
1 metre per second	= 2.24 miles per hour
1 kilometre per hous	= 0.62 mile per hour

Temperature

°F= (°C x 9/5) + 32	°C= (°F - 32) x 5/9

CONVERSION TABLES IMPERIAL TO METRIC

Length

inch	= 2.54 cm
foot	= 0.30 m
yard	= 0.91 m
mile	= 1.61 km

Area

square foot	= 0.09 m^2
square yard	= 0.84 m^2
acre	= 0.40 ha

Weight

ounce	= 28.35 g
pound	= 453.6 g
ton	= 0.91 tonne

Volume (dry)

cubic yard	= 0.76 m^3
bushel	= 36.37 L

Volume (liquid)

fluid ounce (Imp.)	= 28.41 mL
pint (Imp.)	= 0.57 L
gallon (Imp.)	= 4.55 L
gallon (U.S.)	= 3.79 L

Pressure

pound per square inch	= 6.90 kPa

APPLICATION EQUIPMENT USED:

Tank Capacity:

Nozzle Type and Pressure:

Comments:

Tractor Speed or Gear and RPM:

Calibrated Application Rate Per HA or Acre:

APPLICATION INFORMATION							ENVIRONMENT INFORMATION		
Field Identification Location and Size	**Application Date and Time**	**Crop/Weed and Stage of Growth**	**Herbicide** (concentration)	**Product Rate Per Ha or Acre**	**Water Rate Per Ha or Acre**	**No. of Tanks Per Field**	**Wind Speed and Direction**	**Temperature**	**Soil Moisture**

NOTES

Date	Comments

NOTES

Date	Comments

USE HERBICIDES SAFELY

1. **Follow directions!** Read the instructions and follow precautions printed on the container labels.
2. **Protect the eyes** and avoid inhaling chemicals or prolonged exposure of the skin to chemical. Take special care when the herbicide is labelled "poisonous".
3. **Paraquat** - special care should be taken when handling paraquate (Gramoxone), especially the concentrate. Wear rubber or neoprene gloves, coveralls and eye shield. Prevent all contact with skin and eyes. Follow closely all precautions outlined on the product label. Do not apply through an air blast sprayer.
4. **2,4-D and related chemicals** may seriously damage crops of grapes, tomatoes, turnips, tobacco, beans, carrots, sugar beets, fruit trees, ornamental plants, and many others.

   a.) Spray only **resistant** crops. Before commencing, survey the area for the presence of desirable plants that might be damaged by the herbicide. There is a definite risk involved when spraying 2,4-D within 400 metres of a susceptible crop. However, if care is taken, areas closer than this may be sprayed under favorable conditions.

   b.) Spray on calm days or when there is a ligh breeze, away from the susceptible crop, and use as low a pressure as possible to reduce drift of the chemical. Use at least 100 L spray solution per hectare.

   c.) Use an amine formulation whenever possible to reduce vapor drift.

   d.) Use mechanical methods of weed and brush control where the spray risk is high.

   e.) Use a special sprayer for herbicides such as 2,4-D. Such chemicals are almost impossible to remove from a sprayer and traces of them in other solutions may damage susceptible plants.
5. Mixtures of different herbicides, or mixtures of herbicides with foliar fertilizers, insecticides, or fungicides should not be applied to crops in a single application unless recommended on the label.
6. Do not store herbicides near fungicides, insecticides, fertilizers, or other agricultural chemicals.
7. Apply herbicides properly, using the lowest recommended pressure.
8. **Avoid contamination of water supplies**, wells, ponds, streams, etc., when filling or flushing spray equipment, or when spraying. Never fill a sprayer directly from a well, pond or stream unless the unit is equipped with an anti-backflow device to prevent siphoning. Protect against spills.
9. **Rinse all empty metal, plastic, or glass containers** three times with water and add washings to the spray tank, or use a rinsing device. These rinsers can be used to puncture the bottom of a metal or plastic drum, and to rinse the residual left in the container directly into the spray tank. This procedure takes less than a minute and results in a rinsed container. The rinsed containers may be crushed, buried and covered by at least 50 cm of soil, away from any watercourse or water table at an appropriate landfill site.

EMERGENCY AND FIRST-AID PROCEDURES FOR PESTICIDE POISONING

Become familiar with the chemicals you are using. Keep a list of common names in case of accidents or emergencies. This information can be found on the product labels and cross referenced in this publication.

If a pesticide has come in contact with the skin or has been spilled on clothing, remove the clothing and wash the skin thoroughly with soap and warm water.

If pesticide has come in contact with the eyes, rinse them with plenty of clean water for 15 minutes. Repeat this procedure.

If a person suspects poisoning from exposure to a pesticide by swallowing, inhalation, or contact with skin or eyes, read the label on the pesticide container and carry out the first-aid treatment suggested.

IMMEDIATELY AFTER THE FIRST-AID TREATMENT HAS BEEN GIVEN, WRAP THE PATIENT IN A COAT OR BLANKET AND RUSH HIM TO THE NEAREST HOSPITAL. TAKE THE LIST OF CHEMICAL COMMON NAMES WITH YOU AND IDENTIFY THE ONES BEING USED.

IF A PERSON IS FOUND UNCONSCIOUS OR LAPSES INTO UNCONSCIOUSNESS CALL AN AMBULANCE IMMEDIATELY.

EMERGENCY ADVICE ON PESTICIDE POISONING IS AVAILABLE BY CONTACTING THE POISON INFORMATION CENTRES: THE NAMES AND TELEPHONE NUMBERS ARE LISTED UNDER EMERGENCY CALLS AT THE FRONT OF EACH BELL TELEPHONE DIRECTORY.

FILL IN THE FOLLOWING:
MY LOCAL POISON INFORMATION CENTRE TELEPHONE NUMBER IS______________